In This Issue *Advance Papers Pacific Coast Section N. E. L. A. Convention with Departmental Discussions of Vital Interest to Engineers of the West*

JOURNAL OF ELECTRICITY

VOL. XXXVIII NO. 8 SAN FRANCISCO, APRIL 15, 1917 PER COPY, 25 CENTS

Hotpoint

Thumb Rest

— rests the wrist

— makes ironing easier

1917 Model

Hinged Plug Cord Protector

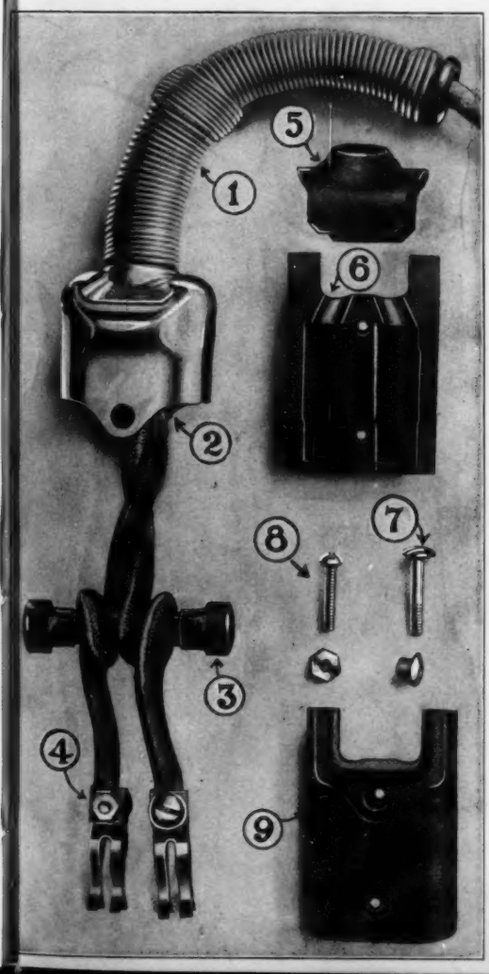
— prevents troublesome cord breakage

— plug easily removable

— plug always cool

WE HELP YOU SELL THIS IMPROVED IRON

by telling the women of the country about it through our advertisements in the leading periodicals



OUR NEXT TWO ADVERTISEMENTS ARE

— a four-color, full page in the May *Ladies' Home Journal* (at news stands April 20th)

— and a two-color, center spread in the April 28th *Saturday Evening Post* (look for it next week—it's on sale April 26th)

THE TWO NEW IMPROVEMENTS

The Thumb Rest appeals instantly to the woman and when she has used it a few days, she would not give it up.

The Hinged Plug and the double Cord Protector eliminate troublesome cord breakage. The grip is always cool and the plug is equipped with new springs, making it very easy to remove.

These improvements mean so much to you men who sell Electric Irons that we are showing a detailed picture of the construction of the plug. Study it. See why cord trouble has been practically done away with.

REFER TO THE NUMBERS ON THE PICTURE

1—Our double protective spring. The outside coil extends about half way, making the lower half more rigid and increasing the bending area of the cord.

2—One piece pressed steel plug cap. It is fitted with a slide hinge joint allowing motion as shown by the picture on the right side of this ad. This still further increases the motion of the cord without wear.

3—A wood plug bar around which the cord is wrapped. This gives a firm anchorage and the pull on the cord is at these wraps rather than where the cord is attached to the springs.

4—Steel contact springs which on account of their shape and temper, are not affected by heat. These springs afford an excellent knife-switch connection. Very easily removed even after long continued service.

5—Fibre insulator lining for steel plug cap (No. 2).

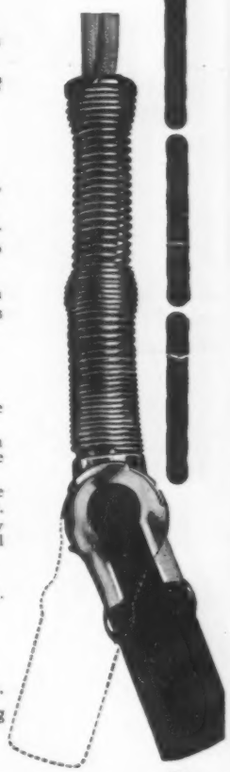
6 and 9—The two halves of composition plug in which contact springs (4) are enclosed.

7 and 8—Screws and nuts for holding plug together.

THE LINE OF LEAST RESISTANCE

Hotpoint Irons are easy to sell because the women know about them and ask for them. We furnish dealer helps of all sorts and our Promotion Department will prepare advertising copy and suggestions for local campaigns.

Write to our nearest office for our 1917 sales plan

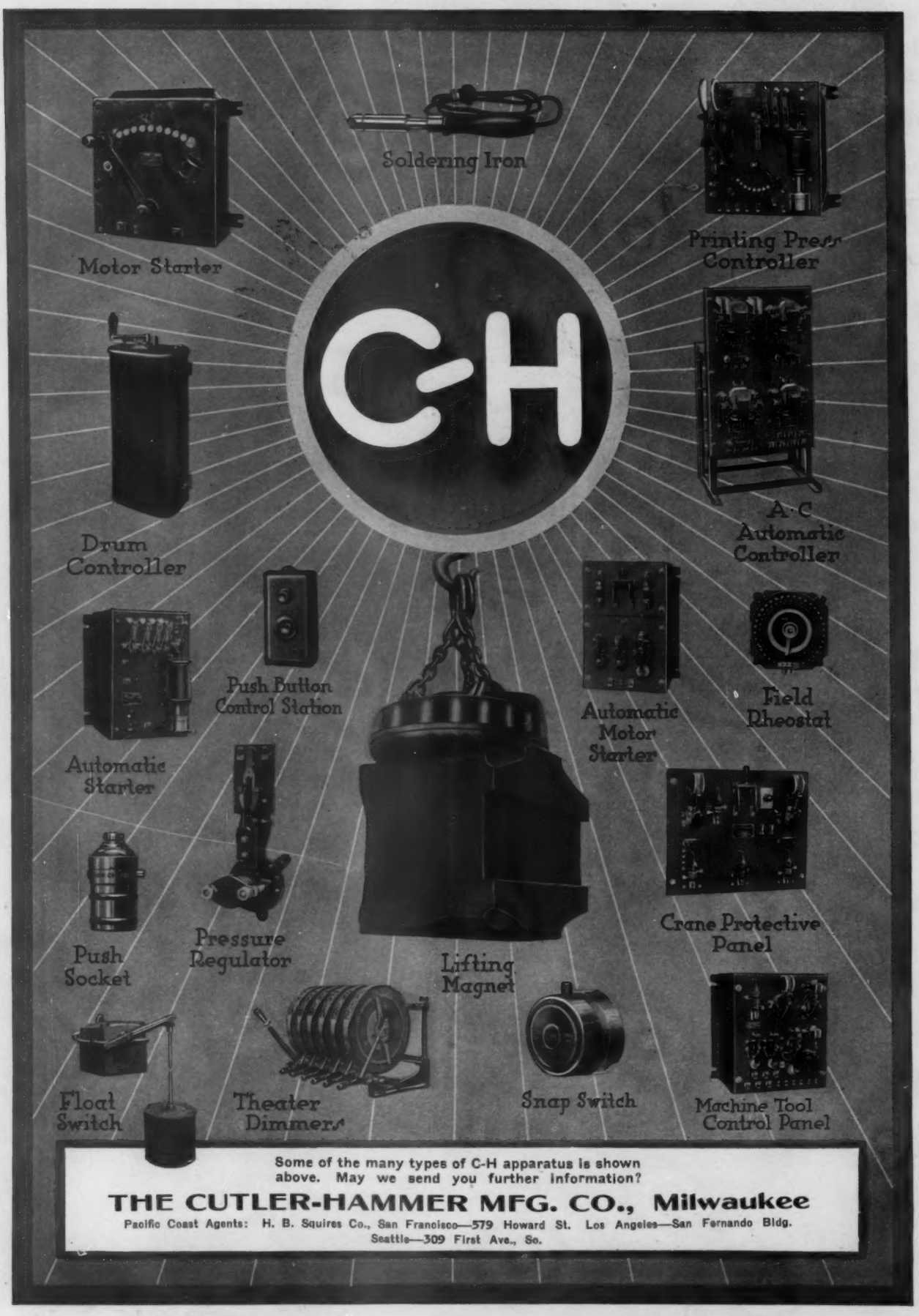


HOTPOINT ELECTRIC HEATING CO., Ontario, Cal.

Chicago New York London

Canadian Hotpoint Electric Heating Co., Limited

TORONTO, CANADA



Some of the many types of C-H apparatus is shown above. May we send you further information?

THE CUTLER-HAMMER MFG. CO., Milwaukee

Pacific Coast Agents: H. B. Squires Co., San Francisco—579 Howard St. Los Angeles—San Fernando Bldg. Seattle—309 First Ave., So.

APR 18 1917
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JOURNAL OF ELECTRICITY

Devoted to the Generation, Distribution and Utilization of Energy

VOLUME XXXVIII SAN FRANCISCO, APRIL 15, 1917 NUMBER 8

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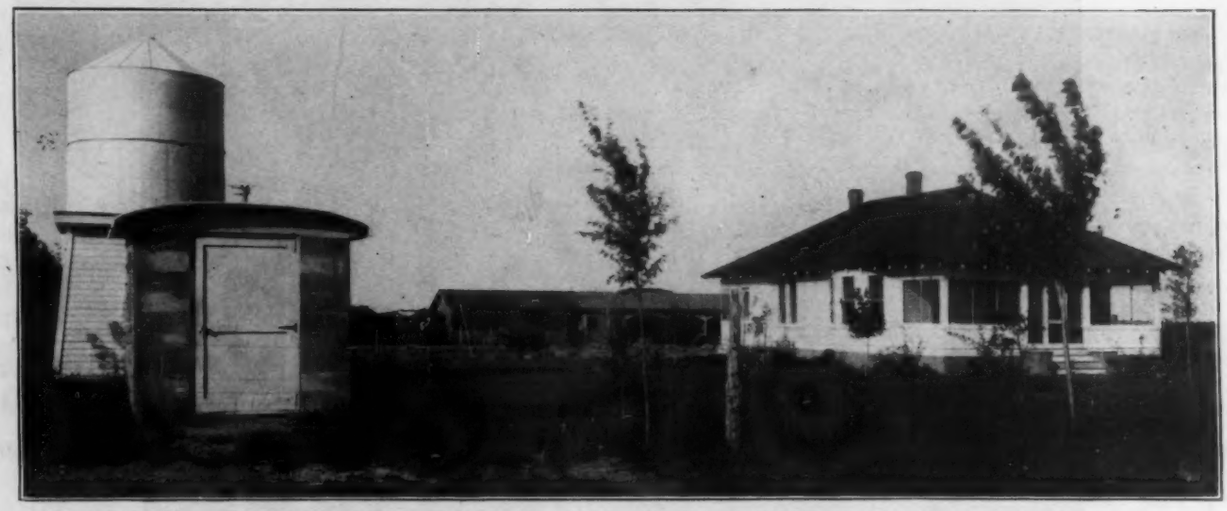
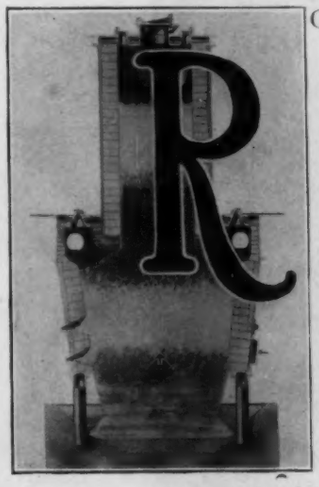


One of the Many Typical Small Farm Units in New Mexico Brought to Life Under Progressive Utility Management

ELECTRIC GENERATION BY PRODUCER GAS

(Producer gas has proved a strong stand-by in certain Eastern centers for electrical development. In the West, due to scarcity of coal supply little has been accomplished along these lines. The coal beds of New Mexico, however, bid well to develop a new and profitable field of usefulness as a home builder in that hundreds of small yet flourishing farm units are being brought to life under irrigation by electrical generation from producer gas. Here is an article that should prove helpful and instructive not only to small central stations, but from it even the larger companies can glean items for future usefulness and inspiration.—The Editor.)



The Gas Producer With Fire Zones

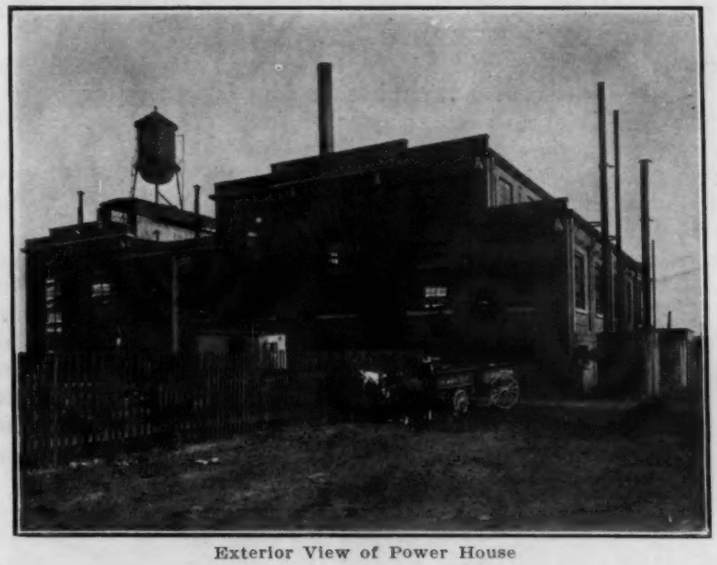
ROSWELL, New Mexico, has the distinction of having a central station which places its main reliance for electric power on producer gas engines and which has taken a leading part in the development of electric power for irrigation pumping. Situated at an altitude of 3600 ft., in the midst of the fertile valley of the Pecos River, in southeastern New Mexico, north of the country where they dig for wood and climb for water, is this city of 8000 people, a modern Mecca for the health-seeker and tourist.

The Roswell Gas & Electric Company serves the electrical needs of the town and of such of the surrounding district as does not possess artesian water. The electrical generating equipment comprises three 250 kw. gas producer sets and a 500 kw. auxiliary steam turbine, the gas producers carrying the load during the irrigation pumping season and the turbine from October to December while the gas engines are being overhauled and also at peak load throughout the year.

The 750 kw. irrigation load is derived primarily from the Berrendo Farms, the oldest of whose apple orchards are bearing fruit for the first time this year. While the 1500 acres of orchard have been coming to the bearing stage, the farmers have been raising livestock and milking cows with success. Half the average forty-acre farm is planted to orchard and the other half to alfalfa and general crops.

All of the houses and barns throughout the tract are completely equipped with lamp-socket electrical devices. Little effort has yet been made to seek the

The Electric Generating Unit of the Roswell Gas & Electric Company, Gas Driven

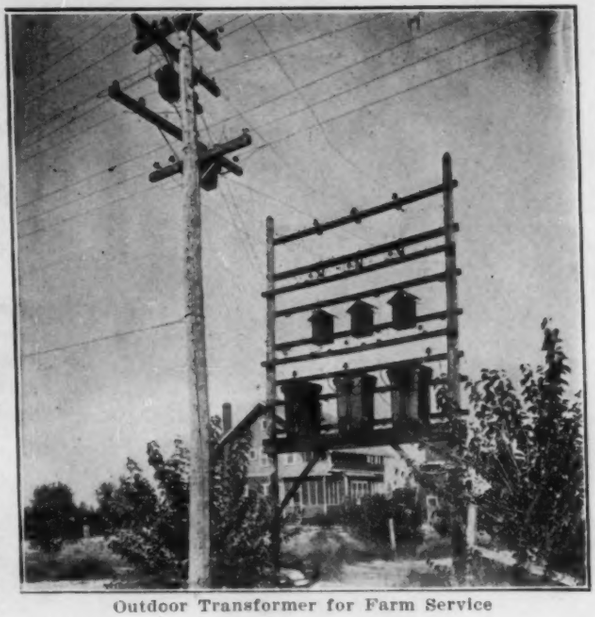


Exterior View of Power House

electric cooking load, though this offers bright prospects.

The most interesting part of the installation is the high efficiency obtained, the operating results showing 4 kw.-hr. per pound of coal. The coal is a good grade of bituminous, obtained from Raton, in the northern part of the state.

The success of a gas producer plant, contrary to a steam plant, depends upon the incomplete combustion of the fuel. Whereas a steam engineer bends every effort to minimize the carbon monoxide, the gas engineer tries to avoid making carbon dioxide. Consequently a gas producer is, in some respects, just the reverse of a boiler furnace.



Outdoor Transformer for Farm Service

The six gas producers at Roswell are of the Westinghouse double zone type, with down draft produced by a suction fan at the gas off-take. Each producer consists essentially of a brick-lined steel shell, 17½ ft. high and 10 ft. square. As indicated by the name, it consists of two zones, upper and lower.

Green coal is charged at the top of the upper zone with just enough air to cause coking. The temperature is high enough to distill the hydrocarbons, which are broken down into marsh gas, hydrogen, and carbon as they are drawn down through the coking zone. This gas is drawn off and the carbon (lamp black) and unburned coke drops into the lower zone, to which the air is supplied from below through a tuyere. As the air passes upward through this zone its oxygen is first converted into carbon dioxide as the coke burns, but as this gas rises it unites with the hot carbon to form carbon monoxide. The carbon monoxide from the lower zone is drawn off from the middle of the producer and mixes with the marsh gas and hydrogen from the upper zone, and both are drawn off to the scrubbers.

The ash drops into a shallow pit in the bottom of the producer shell, the pit being filled with water to act as a seal, which makes it possible to withdraw the ash in a cool and dustless state. Steam is used to regulate the temperature in the two zones, being admitted with the air.

The gas is cleaned by a preliminary spraying in the take-off pipe, then passes through the wet scrubber and then through a dry scrubber, being drawn through the producer and scrubbers by a cycloidal blower discharging into the gas distributing main, which supplies the gas engines through a convenient valve system. Duplicate sets of blowers are provided as a service insurance.

These producers supply gas to three 250 kw. Westinghouse gas engine driven generating sets, two of the engines being vertical and one horizontal. In addition there is a 100 kw. gas engine set at the company's gas plant which supplies current in case of emergency.

Every precaution is taken to prevent shutdown. Each engineer and each gas man is paid a $25 monthly bonus if no shutdown occurs, and are penalized $5.00 each time a residence circuit is disconnected. This recognizes the

View of Business Section of Roswell

fact that the quality of the case is equally as important as the handling of the engine in providing continuous service. It is of interest to add that the engineers usually earn their bonus.

Current is distributed at 2300 volts over a well-constructed distributing system, which follows the alleys throughout most of the town. The main streets are illuminated by 140 cast-iron boulevard posts of the three and five-light type. The 60-watt top lights burn all night and the 40-watt pendant lights till 10 p. m. This lighting system was installed by the property owners, the city paying the cost of current and maintenance. The installation is of the straight multiple type, 110 volts, in steel armored cable.

Because of the abundance of artesian water in this vicinity, electric pumping for irrigation has been necessary only on the higher lands for lifts of from 20 to 60 ft. Centrifugal and turbine pumps are used in most installations, driven by motors of from 20 to 30 h.p. Experience is demonstrating that smaller pumps, driven by motors of from 3 to 5 h.p. and pumping continuously into reservoirs, would give a more satisfactory load to the power company and lower bills to the irrigator.

Particularly noteworthy is the type of outdoor substation illustrated herewith. This two-pole support has been standardized so as to promote economy in construction and is giving satisfaction in every way.

Electric Pumping Brings Abundance of Water for Intensive Farm Products

Rates are based upon a monthly readiness-to-serve charge of $1.00 per connected horsepower during the irrigation season, plus 4½ cents for the first 500 kw.-hr., 4 cents for the second 500, 3½ cents for the third, and 3 cents for all in excess of 1500 kw.-hr., with 1 cent per kw.-hr. discount for prompt payment of bill.

The far-sighted management under which this unusual utility is operated is doing much to build up the surrounding vicinity with profit to itself and to the community by encouraging the small farm load in every way possible.

The Roswell Gas & Electric Company is owned by the Otis interests of Cleveland, Ohio, D. W. Low being general manager and C. M. Einhart general superintendent. To these gentlemen the writer is indebted for the information published.

OZONE FOR THE CHILDREN—VI. OR ENGINEERING TWISTERS RETOLD

Many puzzling questions constantly arise in ordinary conversation that often confuse even the engineer unless careful analysis of fundamental principles of mechanics is closely adhered to.

I had the honor of sitting at the captain's table on a transpacific voyage and having overheard a mathematical dissertation going on at the chief engineer's table upon the propeller shaft wherein entered the moment of inertia, the moment of turning effort and so on until I thought the moment for the sinking of the ship had arrived, I laughingly put the following proposition to the skipper: "Captain, if a boat, designed in still water to steam 8 miles per hour, crashes into a log floating in a river which flows 4 miles per hour, would it be a more serious collision if the boat was sailing up stream or down stream?"

Without thinking very seriously the old skipper closed one eye and promptly replied, "Why a head on collision, of course, would be the worst." As a matter of fact, however, an analysis shows that the effective impact of the crash would be the same in either case. Effective impact, depending upon the added velocities of two moving bodies, determines the dangers to be avoided. Since the log flows with the river and the boat flows with the river, the down stream crash is at once seen to be proportional to a velocity of 8 miles per hour. On the other hand, when traveling up stream the boat, if steam were shut off, still flows with the river downstream, and the log flows down stream, so that the boat operating at full speed up stream would still have the same effective crash in case of a collision—namely that resulting from a crash proportional to a speed of 8 miles per hour.

Effective Flood Lighting of Wise Power Plant, situated near Lincoln Highway and Southern Pacific Lines

EXPERIENCE WITH HIGH HEAD FRANCIS TURBINES

BY J. P. JOLLYMAN

(Until quite recently the proposal of a Francis turbine for operation under a four to six hundred foot head would have been considered too daring for safe and conservative design. Here is an article that tells of recent installations that not only employ such heads as this but also operate at over eighty-six per cent efficiency, with penstock pipe lines and their impounded waters stretching back for a distance of over a mile and one-half. The author is engineer in charge of electric construction for the Pacific Gas & Electric Company and has written this paper for consideration at the convention of the Pacific Coast Section of N.E.L.A. at Riverside.—The Editor.)

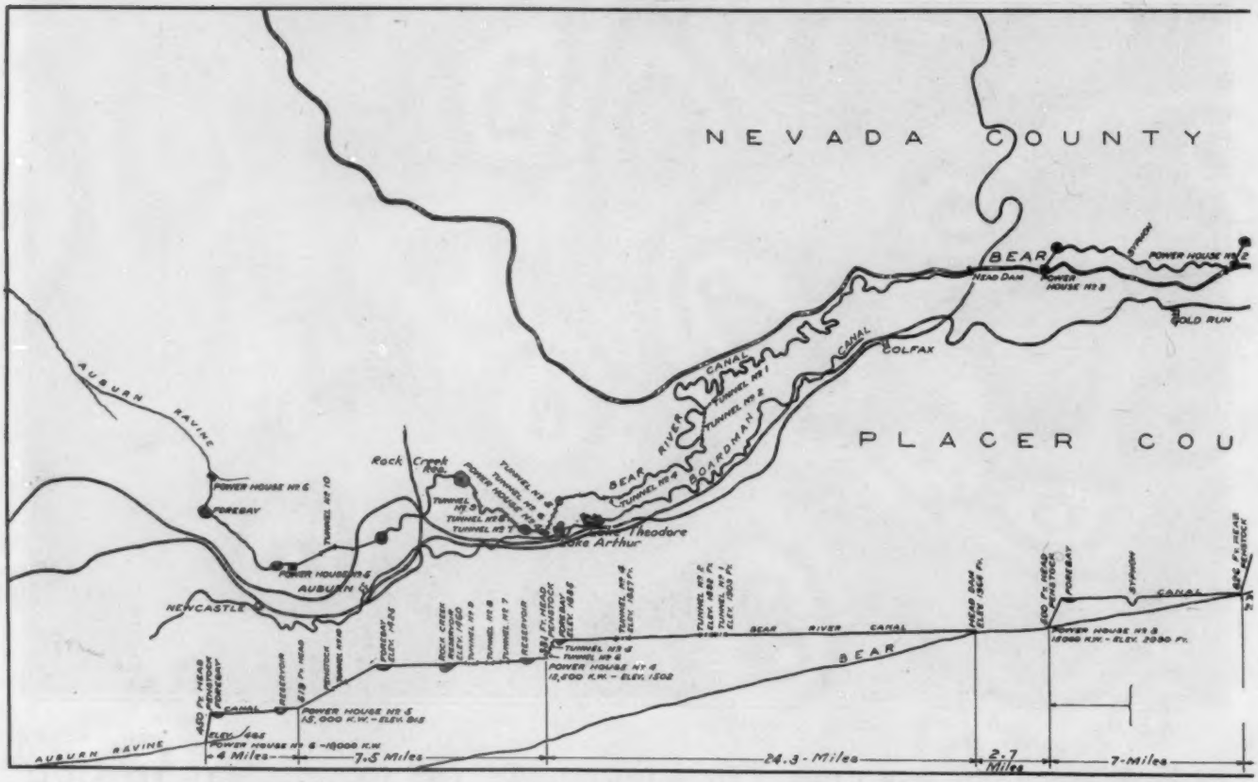
During 1907, at the Centerville power house of the Pacific Gas & Electric Company, we installed an Allis-Chalmers 9000 h.p. 400 r.p.m. horizontal, single discharge turbine under 577 ft. head. The penstock is 2576 ft. long. At the time of its manufacture, this turbine represented a very considerable advance in head compared with anything in service in this country. When first installed some difficulty was experienced in obtaining satisfactory balance against end thrust due to insufficient provision for automatically balancing the runner. A change in the setting of the thrust bearing largely overcame this difficulty and permitted regular operation of the unit.

Careful tests made with a weir showed a maximum efficiency of 86 per cent. This is very satisfactory as it is 2 per cent to 4 per cent better than that of the impulse wheels available at that time.

While the water is fairly clear, some grit is carried at times of storms. Some wear of the runner became apparent within a year, but the efficiency did not drop off until after several years. After seven years of practically continuous operation the wear was considered sufficient to justify renewing the runner, guide vanes and the plates on either side of the guide vanes. The new parts were provided with balancing chambers on both sides of the runner of a design which had been perfected since the turbine was first installed. All end thrust is now taken by the balance chambers and the thrust bearing is only called on to prevent the runner from striking the crown plates when the guide vanes are closed.

After two years of service a few places in the new bronze runner commenced to cut a little. These were filled by the oxyacetylene process.

The Penstock Piping at the Wise Power House
8546 ft. in Length



Map of Spaulding Development showing

This turbine has the very low specific speed of 13; in other words the ratio of runner width to runner diameter is very small as must be the case with any turbine for high head, moderate speed and medium output.

We consider that the success of this turbine removes any doubts we may have had concerning the feasibility of the Francis turbine for heads up to about 800 ft. where the output and speed can be adjusted to give specific speeds of 12 or more.

The governor operated relief valve supplied with this turbine successfully controls the pressure on sudden rejection of load by the turbine. The turbine governor was equipped with a load limit device so arranged that the maximum gate opening of the turbine could be easily adjustable. This was necessary as the plant has practically no forebay and the flow in the canal is subject to some fluctuations. This unit is not called on to govern.

Partly due to the success of the turbine at Centerville, our Halsey power house with 328 ft. head and our Wise power house with 519 ft. head were decided upon as series plants in our South Yuba Development.

Each of these plants is equipped with a single 12,500 k.v.a., 360 r.p.m. generator.

The generator at the Halsey power house is driven by two Allis-Chalmers 9000 h.p. horizontal single discharge turbines whose runners are mounted directly on the overhung ends of the generator shafts. This plant was put into service December 6, 1916, so we have had no experience with wear as yet. The plant has been given a thorough tryout under all loads and under sudden rejection of load. The balancing of the turbines and the action of the governor-operated relief valves is very satisfactory. The penstock is 5418 ft. long and has no stand pipe or air chamber. As at Centerville, the governors are controlled by load limit devices. These turbines have a specific speed of 24.5 and are not extra high head. Preliminary tests indicate that the maximum guaranteed efficiency of 86 per cent has probably been exceeded.

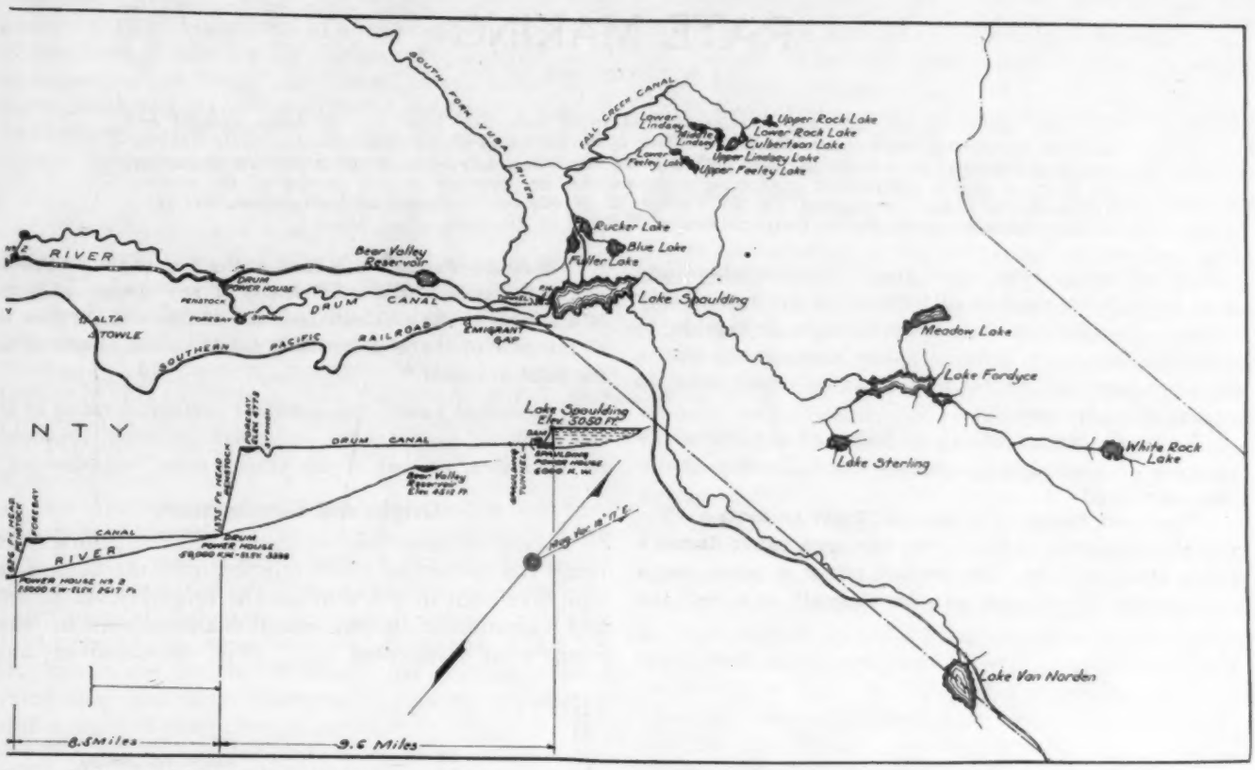
The generator at the Wise power house is driven by one Pelton-Doble 18,000 h.p. single discharge turbine over-hung on one end of the generator shaft. This turbine has a specific speed of 20 and is believed to have the largest output of any single discharge horizontal turbine yet constructed. The penstock is 8546 ft. long and has no stand pipes or air chambers. The turbine is equipped with a governor-operated relief valve. This plant was put into service March 4, 1917, and was immediately given a careful tryout under load and for behavior under sudden loss of load. As high as 10,000 kw. was dropped instantly with a penstock pressure rise of 11 per cent. In view of the long penstock this result is regarded as very good.

The turbine operates smoothly when under load, and the balance against end thrust is good. Here again the governor is controlled by a load limit device.

Preliminary tests indicate that the guaranteed efficiency of 86 per cent has been exceeded.

When it is remembered that at 519 ft. head and 360 r.p.m. a single jet impulse wheel could develop only about 1000 h.p., the simplicity and desirability of a single 18,000 h.p. turbine is very apparent.

We shall watch the performance of these two new plants with great interest, but have no doubt of their success in view of the success of our Centerville plant.



Drum, Halsey and Wise Power Plants

GOVERNMENT REGULATION OF GERMANY'S WATER POWER

In the division of government powers in Germany between the federal and state jurisdictions the regulation of waterways and waterpower development falls to the states. The most important legislation on the subject comprises laws enacted by Hesse in 1887, Alsace-Loraine in 1891, Baden in 1899, Wurtenberg in 1900, Bavaria in 1907, Saxony in 1909, and Prussia in 1913.

It has been the policy of Prussia in the past to leave the development of waterpower sites to private or local communal enterprise. More recently, however, a reversal has taken place, and the State has itself intervened to build power plants and undertake the distribution of the power developed. This has already been done on the Lippe at Hamm, on the Weser at Dorveden, and at certain places on the upper reaches of the same stream.

Under the scheme that has been followed in the development of the waterpower sites on the upper Weser, the state appropriates the amount needed to construct the hydroelectric plant, together with auxiliary works such as locks, etc., and for the erection of the transmission system for distributing the electricity.

The government is authorized to obtain the money appropriated by the issuance of bonds to the amount of the appropriation, or by the issuance of treasury notes. The actual work of construction is carried out by the waterways department of the Ministry of Public Works, and the subsequent operation of the completed plant, and its business administration remain in the same hands.

MEASURING GROUND-WATER SUPPLIES

In few places is water more valuable than in the well-known Santa Clara Valley, Cal, where large supplies are pumped out of the earth for the irrigation of prunes and other crops and for use in the cities on San Francisco Bay. For several years investigations to determine the quantity of underground water annually available for use in this valley have been made by the Department of the Interior through the Geological Survey in co-operation with the California State Department of Engineering. In 1915 a report by W. O. Clark, published by the Survey, gave an estimate of the supply in the area known as the Niles cone, and a similar report is now announced for the area around the village of Morgan Hill.

The ground-water level in the Morgan Hill area rises during the rainy season 10 to 45 ft., or an average of about 19 ft. As the water-bearing materials underlie about 15,700 acres of the area and have an estimated available porosity of about 12 per cent, it was calculated that this rise in water level requires a storage of ground water during the rainy season of about 34,000 acre-feet, or practically sufficient to meet the needs of irrigation if the area is planted to orchard.

Recently four gaging stations have been established at points along Coyote River to determine how much water this stream loses by percolation into the gravel deposits that underlie the Morgan Hill area. These determinations will form a check on the estimates based on rise of water levels.

The report on the Morgan Hill area, which is known as Water-Supply Paper 400-E, can be obtained free of charge by applying to the Director, United States Geological Survey, Washington, D. C.

RATE MAKING

BY W. G. VINCENT, JR.

(The subject of flat rates and socalled straight meter rates has been one of much thought and study on the part of engineers of the West. Here is the embodiment of a combination of these two fundamental principles of rate making, that should prove immensely helpful to utility companies throughout the West, in that it has evolved itself from problems that are peculiar to this section of the country. The author is evaluation engineer for the Pacific Gas & Electric Company and will present this paper at the convention of the Pacific Coast Section of N.E.L.A at Riverside.—The Editor.)

In discussing rate questions, misunderstandings often arise from the use of terms that are not clearly defined; therefore it has been thought advisable to begin this paper by defining a few expressions whose meaning may not be entirely clear to many who do not use them frequently.

From the Standardization Rules of the American Institute of Electrical Engineers the following definitions are cited:

"The Load Factor of a Machine, Plant or System.—The ratio of the average power to the maximum power during a certain period of time. The average power is taken over a certain period of time, such as a day, a month, or a year, and

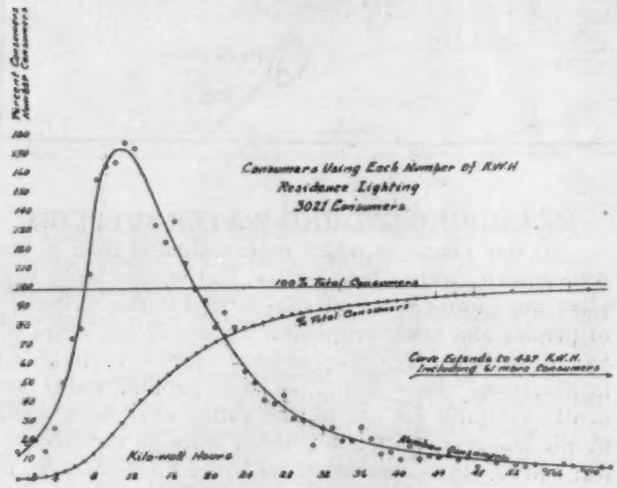


Chart for Residence Lighting

the maximum is taken as the average over a short interval of the maximum load within that period.

"In each case, the interval of maximum load and the period over which the average is taken should be definitely specified, such as a 'half-hour monthly' load-factor. The proper interval and period are usually dependent upon local conditions and upon the purpose for which the load factor is to be used."

"Plant Factor.—The ratio of the average load to the rated capacity of the power plant, i.e., to the aggregate ratings of the generators."

"The Demand of an Installation or System.—The load which it puts on the source of supply, as measured at the receiving terminals. The demand may be as specified, contracted for, or used. It may be expressed either in kilowatts, kilovolt-amperes, amperes or other suitable units."

"The Maximum Demand of an Installation or System.—Its greatest demand, as measured not instantaneously but averaged over a suitable and specified interval, such as a "five-minute maximum demand.'"

"Demand Factor.—The ratio of the maximum demand of any system or part of a system, to the total connected load of the system, or of the part of system, under consideration."

"Diversity Factor.—The ratio of the sum of the maximum power demands of the subdivisions of any system or parts of a system to the maximum demand of the whole system or of the part of the system under consideration, measured at the point of supply."

"Connected Load.—The combined continuous rating of all the receiving apparatus on consumers' premises, connected to the system or part of the system under consideration."

Origin and Development

Many of those now operating electric utilities can recall the history of these utilities from the beginning and have seen in a few years the origin, development and transition of the rate situation almost without realizing what was going on. This development and

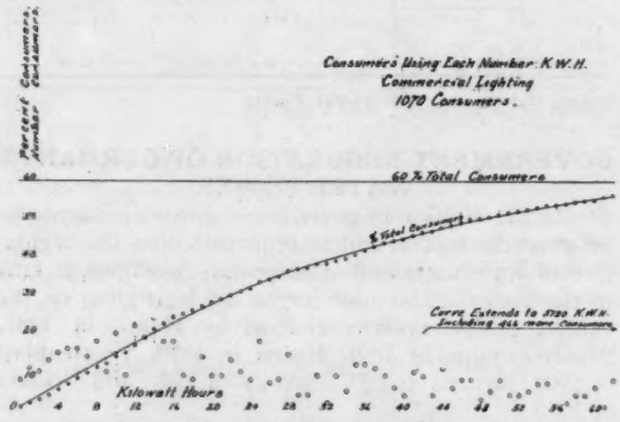


Chart for Commercial Lighting

transition has all occurred within a very few years and is practically identical with what has occurred elsewhere in electric rates and also in gas rates, though in the latter case over a much longer period.

In the beginning there were no meters, all electric service was supplied on flat rates, which was the only available method of charging. These flat rates were demand rates, i.e., the charge was based entirely upon the consumer's demand. It was soon recognized that this method was wasteful and unfair, and with the development of the meter, flat rates were in general superseded by meter rates of the "straight" type. Owing to the large water power development, and the slowness to appreciate the importance of diversity factor, flat rates have persisted on the Pacific Coast even down to the present time, although they are now fast disappearing.

After first trying flat rates and finding them inadequate and then "straight" meter rates and finding that they did not meet all of the requirements, the next step was to develop a rate which would embody the desirable features of both. The earliest form of such a combination was known as a "differential rate" in the

gas industry and consisted of a rate carrying discounts of one kind or another for the larger quantities, such as in our present "step" and "block" rates. Later there were developed many other forms, using as a basis a fixed charge determined by the demand and a variable charge dependent upon the energy used.

Costs Analyses

During the early consideration of the problem, there were contributed to the literature on rates several papers and articles which have remained to this day as classics, enunciating as they do the fundamental principles of rate making, and around which practically all discussions have since centered. While it is not intended in this paper to go into the details of the ideas presented in these papers, it is not possible to discuss the subject at all without at least briefly mentioning a few of them.

Dr. Hopkinson in 1892 analyzed for the first time the costs of electric utility operations and pointed out very clearly that a large part of the charge should be placed upon the demand of the consumer and the balance upon the energy used. It seems probable that prior to the presentation of this analysis by Dr. Hopkinson any variations from the flat or straight meter rates that had been made were due to expediency rather than to competent analysis.

Mr. W. J. Green of New York, in an article in the Electrical World in 1896, analyzed very carefully the cost of supplying electricity, and for the first time brought out the importance of the expenses occasioned by the consumers, independent of their demands and the energy required by them. This analysis developed the basis for what has since been called the three charge system, consisting of consumer, demand and energy charges.

In 1896 Mr. Arthur Wright first described the Wright Demand System in a paper presented before the Municipal Electrical Association, Whitehall, England. This system had been put in practice in England as early as 1893 along lines somewhat similar to those adopted by Mr. Green. The basis of apportionment of expenses used by Mr. Wright was quite similar to that used by Dr. Hopkinson, both placing all the investment charges and expenses, independent of the actual output of the plant, into what was called by one a "Readiness-to-Serve" and by the other a "Demand" charge. Dr. Hopkinson using the installations as a basis for pro-rating this readiness-to-serve charge between the different consumers, and Mr. Wright's theory was that these charges were to be divided proportionately to the maximum demand of each consumer at the time of the station peak.

In 1900 Mr. Henry L. Doherty in a paper before the National Electric Light Association laid down the principles of the three charge rate, which he had successfully applied in practice.

The work of these men and many others has defined the principal factors affecting the costs of supplying electricity, and other classes of utility service, such as water, telephone, gas, etc., as well as other lines of business in which their analogies are found. These factors which affect and largely determine the cost of supplying service by every electric utility, briefly stated, are:

First—The number of consumers supplied.

Second—The maximum demand upon the plant made by the consumers.

Third—The amount of electricity required by the consumers during a given period of time.

The influence of these three variables on costs is generally recognized and in all complete cost analyses they are used as a basis for segregating expenses. There is, however, some difference of opinion as to their relative influence on the various classes of costs, but on the whole these differences are matters of detail and do not affect the general principles involved.

Every utility should make a complete analysis of its operating and maintenance costs and fixed charges, as only with this knowledge can the utility deal intelligently with many of the problems covering rates, extensions, reconstruction, etc., that confront it from day to day.

Basis for Rate Fixing

While the proper basis for fixing rates is still a matter for discussion and very few of the regulatory bodies have committed themselves to any definite rules on this subject, it must be admitted that the method most commonly employed by regulatory bodies is based primarily on cost, the value of the service and other elements being considered only when it has been found that the cost theory consistently followed, would not produce the best results for all concerned. As illustrating this method we may refer to the San Jose Electric Rate Case where, after determining the total cost of serving all classes of consumers, the California Railroad Commission then analyzed this total and segregated it between the costs of supplying several of the principal classes of service, such as street lighting, street railway, residence and commercial lighting, industrial and agricultural power, etc. After comparing the result of this segregation with the revenues from each class, it found that while the lighting revenue exceeded the costs, on the other hand the industrial and agricultural power revenue was less than the expense charged to these classes. The commission reduced the lighting rates but still left a margin above the costs about equal to the loss in the power business, leaving the power rates unchanged, Commissioner Thelen saying in the decision:

"While I am of the opinion that each class of business should at least yield a revenue such as would not under average conditions create an additional burden upon the other classes of consumers, it does not necessarily follow that all classes of service should show the same degree of profit or yield the same percentage of return as every other class."

"While it appears from the segregation of costs hereinbefore made that the residence and lighting business will produce a net revenue materially in excess of its segregated charge, it by no means follows that the same conclusion would be true if, through an increase in the rates for agricultural power, defendant should lose a considerable part of this class of business."

The above is quoted for the purpose of showing that the commissions recognize the necessity of considering the existing conditions and that it is not practicable in all cases to establish a system of rates worked out from a purely theoretcal standpoint.

The United States Supreme Court in its decision, the so-called North Dakota Lignite Coal case, dis-

cussed the question of class rates and the following comment on this decision from the report of the Rate Research Committee of the National Electric Light Association for 1916 will be found of interest:

"The court holds that a state cannot compel a railroad to carry a preferred class of freight at a rate (specified by the state) which merely returns the increment cost of the service. The court holds that when the state undertakes to establish a rate for a given class of service, the costs pertaining to that class must be determined, assigned and charged thereto and that overhead and general expenses must be fairly apportioned between that class and all other classes. The intent of the rate which was set aside by the court was to develop the lignite coal industry in the state of North Dakota. In setting it aside the court painstakingly avoided saying that the railroad might not make such a rate with such an intent if it so pleased. The dictum is, that broad as is the state power of regulation, nevertheless the state does not enjoy the freedom of the owner of the public utility in such matters.

"In the same decision the court after having thus stated the cost of service theory, guards against the foolish application of that theory by the following language:

> 'The legislature undoubtedly has a wide range of discretion in the exercise of the power to prescribe reasonable charges and it is not bound to fix uniform rates for all commodities or to secure the same percentage of profit on every sort of business. There are many factors to be considered—differences in the articles transported, the care required, the risk assumed, and the value of service, and it is obviously important that there should be reasonable adjustments and classifications.' "

"There are two lessons for us in this decision. First, that in making a rate for a specified service we must truly know the costs of our service; not only the costs directly pertaining to that class but the reasonable proportion of overhead and general expenses which should be borne by that class. We do not suggest amplified classifications. The decision contemplates 'reasonable adjustments and classifications' which we interpret to mean those indicated by common sense. Neither do we offer any rule or method of analysis—these are matters beyond the scope of this committee. Our point is that the making of any classification, be it broad or narrow, implies a co-existent analysis of costs by like classes.

"The second lesson is that the highest court rejects the contention of the extreme theorist who insists that we should obtain the same percentage of profit on every sort of business, or (it may be) on the business of every individual customer; and equally rejects the contention of the ignoramus or mischief maker who clamors for identical rates for all services. It is no longer necessary to caution our membership against either of these errors, but we note that the extreme theorist and the mischief maker are not dead, and that we have had to listen and reply, even in the past year, to the man who wants us to sell all our service on a single straight line kilowatt-hour rate, and to the other man who wants us to determine so exactly the cost of service to each customer that our power plants and distribution systems would become merely unavoidable preliminaries to the operation of a meter department."

Rate Schedules

A rate schedule is a set of rules for billing consumers for service, and the principles or theories upon which it is based are not complex and may be expressed in simple terms. Whatever complications appear are more often introduced in an effort to develop a system of charging consumers with varying requirements for the amount which each should pay, and are not inherent in the basic principle upon which the schedule is predicated. There are really two questions involved, the theory of rates and the art of bill making.

In the early days of the electric utilities when the number of consumers was small, and the classes of service few, the rate schedule was a simple matter to prepare, but as the business developed and not only the classes of consumers increased but the individual requirements of consumers in the same class enlarged and extended, the rate schedule has of necessity become more elaborate in order that it should adequately fulfill its function.

In addition to the general growth of the business, another factor affecting electric utilities which has had a very decided influence upon the schedule is public regulation and particularly regulation by commissions where uniform rates must be filed and "deviations" are not permitted. Before these requirements were made, the making, changing, withdrawing and interpreting of schedules was almost entirely in the hands of the utilities, and adjustments found necessary or desirable could be made at will. Under commission regulation this is a more difficult procedure and hence it is necessary that the rates should be very carefully phrased and specify explicitly what they are not intended to cover, as well as what they are intended to cover.

Two recent commission decisions, one by the Montana Commission and one by the New York Commission (2d district), are of interest, as indicating difference of opinion between commissions and also as indicating the necessity for defining clearly to what class of service a schedule is applicable.

Both cases involved the question of whether a moving picture theatre was entitled to the power rate for operating a motor generator. The Montana Commission decided the power rate should be given, provided the power was not used to generate electricity to be used for general illumination. The New York Commission decided the power rate applied, even if the power was used to operate a motor to drive a generator to supply electricity for general illumination.

A rate schedule should, if possible, be of such a form and so expressed that it may be easily understood by the consumer, but under the conditions already referred to this is becoming more and more difficult, and its importance after all may have been over-estimated. In other words, considering the wide range of conditions that we have to design our rates to meet, are we not expecting too much when we also require that they be "easily understood by the consumer?" Even if we sacrifice many other things in order to attain this end, will the consumer really endeavor to understand them, or are our sacrifices made in vain?

A consumer asking for a power rate should not merely be handed a schedule designed for the purpose of billing thousands of consumers with wide diversities of requirements, and so worded as to condense the expression of many ideas and definitions, often of necessity technical, in a minimum space, but he should also be given either verbally or, preferably in memorandum form, an interpretation of the schedule in terms of his individual requirements. This is what the consumer wants and can be made so simple as to be easily understood by him. Every solicitor or other employee

who constitutes a point of contact between the consumers and the utility should thoroughly understand the schedules and be able to interpret the application of a general rate into very simple terms for any specific case. This is a very important matter that in many cases does not receive the attention that it should from those operating utilities.

Types of Rates

The descriptions and illustrations of the principal types of rates in general use, that have recently been published as a preface to the N. E. L. A. Rate Book, and which were also published in the N. E. L. A. Bulletin for February, 1917, will be found of interest to all concerned with rate questions.

Types of Electric Rates Used in the Larger Cities †

Type of Rate	Residence Lighting — No. Cities	Residence Lighting — Population Served	Commercial Lighting — No. Cities.	Commercial Lighting — Population Served	Retail Power — No. Cities	Retail Power — Population Served
Meter Rates:						
Straight Line Meter Rate.....	*24	3,062,063	*8	882,699	*14	1,765,516
Block Meter Rate.....	*40	9,063,383	*35	7,274,188	30	7,251,082
Step Meter Rate.....	*14	1,199,830	11	791,977	13	1,032,978
Demand Rates:						
Wright Demand Rate Regular....	23	7,045,899	39	10,850,588	42	11,608,721
Room Basis of Demand.....	9	2,308,743	..	.....	..	.....
Socket Basis of Demand.....	1	233,650	..	.....	..	.....
	33					
Hopkinson Demand Rate.....	1	48,443	18	2,944,410	12	1,085,565
Three-Charge Demand Rate.....	...	.....	1	218,149	1	218,149
Total	112	22,962,011	112	22,962,011	112	22,962,011

*Each of these includes one city where the rate is made up of a small monthly customer charge in addition to the energy charge.

†From "Rate Letter" of Norton, Bird and Whitman—September, 1916.

As illustrating the diversity in the form of rates charged in the larger cities, the following table is of interest:

Present Problems

Among some of the larger rate problems confronting utilities as well as commissions may be mentioned the following:

Lighting Rates.—What form of lighting rate should be adopted? Should there be a different schedule for residence and for commercial lighting?

On this last question it is of interest to note that while several of the commissions have made one rate apply to both classes of service, the Illinois Public Utilities Commission has recently expressed its opinion on this subject as follows:

"The respondent's existing electric rate schedules do not differentiate between the residential and commercial (or business-house) lighting service—a customary differentiation in classification among electric utilities; and this commission believes it to be a proper differentiation, due to inherent characteristics which render the average residential consumer proportionately more costly to carry than the average commercial lighting consumer. In the schedules fixed hereinafter, the commission, for the reason given has established separate classifications for residential and commercial consumers, where a single classification previously existed in the city of Lincoln (unless it may be considered that the previous different percentages of connected load, for a determination of maximum-demand, constitute a different classification)."

"By not differentiating between electric rates to residential and commercial consumers, in effect, there results a disproportionate assessment of costs to the two classifications. An exhaustive study of the fixed charges and operating costs herein, and an extensive analysis of the characteristics of the said classifications, disclose that the unit costs of serving residential consumers in the city of Lincoln are slightly higher than the unit costs of serving commercial consumers."

(From City of Lincoln vs. Lincoln Water & Light Company. Complaint as to Rates for Water and Electric Service. Decision of the Illinois Public Utilities Commission, Fixing Rates. November 28, 1916).

As indicating some of the factors which must be considered in fixing lighting rates, the results of an analysis of the characteristics of a fairly large group of lighting consumers, which was made a few years ago, may be of interest.

In connection with a rate case an inspection was made of the connected load of a number of lighting consumers, both residence and commercial, and their actual consumption taken for an average month, from which data the following tables were compiled.

Table I.
Residence Consumers

Consumers	Conn. Load Limits (Watts)	Conn Load Lighting	Power Consumed kw.-hr.	Hours Use Full Conn Load	kw.-hr. Used per Consumer	Average Connected Load
26	0-250	5,033	420	83.5	16.2	193
105	251-500	42,125	1,827	43.4	17.4	400
349	501-1000	261,111	6,052	23.2	17.4	748
132	1001-2000	170,257	3,251	19.1	24.4	1,290
23	2001-4000	59,225	943	15.9	41.0	2,570
5	4001-8000	24,841	430	17.3	86.0	4,968
640		562,592	12,923	23.0	20.2	880

Table II
Commercial Consumers

Consumers	Conn. Load Limits (Watts)	Conn Load Lighting	Power Consumed kw.-hr.	Hours Use Full Conn Load	kw.-hr. Used per Consumer	Average Connected Load
97	0-250	16,508	1,582	96.0	16.3	170
150	251-500	56,429	5,168	92.0	34.4	376
243	501-1000	175,034	13,169	75.0	54.1	720
220	1001-2000	320,860	25,642	80.0	116.4	1,460
119	2001-4000	337,817	23,321	69.0	196.0	2,830
59	4001-8000	334,014	22,136	65.2	375.0	5,660
40	8001- +	821,205	46,471	56.5	1161.8	20,530
928		2,061,867	137,489	66.5	148.0	2,220

Table III
Residence and Commercial Consumers

Consumers	Conn. Load Limits (Watts)	Conn Load Lighting	Power Consumed kw.-hr.	Hours Use Full Conn Load	kw.-hr. Used per Consumer	Average Connected Load
123	0-250	21,541	2,002	93.0	16.3	175
255	251-500	98,554	6,995	71.0	27.4	386
592	501-1000	436,145	19,221	44.0	32.5	737
352	1001-2000	491,117	28,893	59.0	82.2	1,390
142	2001-4000	397,042	24,264	61.0	171.0	2,800
64	4001-8000	358,855	22,566	63.0	352.0	5,600
40	8001- +	821,205	46,471	56.5	1161.8	20,530
1568		2,624,459	150,412	57.2	96.0	1,675

While the consumers used as a basis for the above tables were considered as representative, they were not all of the consumers in the city in question. A further analysis of the consumption of all of the consumers was made for an average month and the results showing separately for residence and commercial consumers are shown graphically on two charts. On each chart are two curves, one representing the number of consumers using each number of kilowatt-hours and the other curve the percentage of the total consumers using not more than each number of kilowatt-hours.

It is interesting to note on the chart for residence consumers that while the average consumption was about 20 kw.-hr., about 70 per cent of the consumers were using less than the average, 50 per cent using not over 15 kw.-hr., and there were more consumers using approximately 12 kilowatt-hours than any other quantity.

This indicates the danger of dealing with averages, for if we were to make a combination one meter lighting and cooking rate of the block type, of 20 kw.-hr. at a top rate to take care of the lighting, and then apply this rate to the lighting consumers shown on the chart, we would find that only 93 out of 3021 consumers are using 20 kw.-hr. for lighting, while 2000 of the consumers would have to do some of their cooking on the top rate block designed for lighting and 931 would do some of their lighting on the low rate block designed for cooking.

Heating and Cooking Rate.—This is a comparatively new development and an analysis of the rates made for this class of service during the last few years by various utilities and commissions indicates the wide divergence of opinion that still exists as to the most desirable form of rate. Some of the questions concerning rates for this class of service are: What form of schedule is best? Shall we make a one meter rate in combination with the lighting load? What shall we make the top rate? Are we justified in making a lower rate for this service than for small power? How can we handle water heating?

There are also some important engineering problems to be considered in connection with the handling of a large amount of business of this class and on which we have very little data to work.

Agricultural Power Rates.—Here again is a comparatively new development in the use of electricity, which introduces special problems due not only to the class of service required and its isolated location, but also to the radical differences in local conditions.

This paper, which has been hastily prepared primarily for the purpose of opening the discussion on this large subject, has been purposely confined to the consideration of some of the general problems of rate-making, recognizing that there are many other questions of vital importance to be studied, and it is hoped that they will be brought out in the discussion.

WATER RESOURCES OF THE NORTH PACIFIC

The United States Geological Survey, Department of the Interior, has published as Water-Supply Paper 393 its annual volume for 1914 showing the results of measurements of the principal streams in the Snake River basin. The field work was done by the Federal Survey in co-operation with the states of Idaho, Oregon, Nevada and Washington. Gaging stations were maintained during the year at more than 150 points. These records of the behavior of rivers throughout a year and year after year are of the utmost importance to engineers who are considering projects for obtaining a supply of water for irrigation, power, or any other purpose.

A copy of the report may be obtained free on application to the Director of the Geological Survey, Washington, D. C.

ELECTRIC ACTIVITY IN ORE DEPOSITS

The marvelous accomplishments in electric science have far surpassed anything that men would have dared to predict in the early days of its development, yet certain prophecies in regard to it have remained unfulfilled. Among these are the suggestions of some geologists that electric phenomena might play an important part in the formation of ore deposits and that electric methods might be utilized in prospecting for ore bodies. Both these suggestions, in the light of the growing knowledge of ore deposits and of electricity, appear to be illusions. It is now clear that the great causes of ore deposition are not electric in the ordinary sense and that the electric currents generated in ore deposits are far too small to aid a prospector in discovering ore by their influence on a galvanometer or other electric apparatus held in his hands.

If however electricity is denied a leading part in the formation of ore deposits its action can not be excluded entirely. It is well known that many chemical reactions are capable of developing measurable electric currents, and it should therefore be expected that in places where chemical action is in progress in ore deposits today electric activity should also be detectable. This has indeed been shown to be the case by several experimenters, and miniature batteries can be formed with water for the battery fluid and certain metallic minerals common in ore deposits as the poles. A report entitled "Electric Activity in Ore Deposits," by Roger C. Wells, recently issued by the United States Geological Survey, records a series of careful measurements of the electric potentials developed when various metallic minerals common in ore deposits are in contact with water or with solutions of various salts. Mr. Wells concludes that the character of the solutions has fully as great an influence on the electric activity developed as the nature of the metallic minerals and that in general acid and oxidizing solutions give the highest potentials and alkaline and reducing solutions the lowest. Economic geologists have long recognized that the solutions in the upper oxidized portion of many ore deposits are acid and oxidizing, while farther down they become neutral or alkaline. Whether such variations and electric differences dependent upon them are sufficient to cause an appreciable electric current to flow from the upper part of an ore deposit to a lower part or vice versa is still an open question. Surely such action, if it exists, is of relatively minor importance in controlling ore deposition, the main factor being the actual movement of metal-bearing solutions from one place to another. Measurements of electric potential can, however, be quickly and easily made and may prove very useful in indicating the direction and intensity of the chemical reactions of which they are one expression.

SUMMARY FOR RECLAMATION WORK, 1916

The United States Reclamation Service furnished water for irrigating about 1,000,000 acres of land; has available reservoir capacity of 9,000,000 acre feet; has dug nearly 11,000 miles of canals and drains; and built 100 storage and diversion dams, as follows:

	No.	Volume
Masonry	42	2,000,000 cu. yds.
Earth	39	10,000,000 cu. yds.
Rockfill and crib	19	1,000,000 cu. yds.
Total	100	13,000,000 cu. yds.

A SYMPOSIUM ON DISTRIBUTION PRACTICE

(Unusual features experienced nowhere else in the world are encountered in irrigation service of the West in the use of transformers, distribution fuses, switches and insulators. Here is a symposium on such practice in the West invaluable to the electrical engineer. These papers have been written for consideration at the Pacific Coast Section Convention of N. E. L. A. at Riverside.—The Editor.)

DISTRIBUTION CUT-OUT AND TRANSFORMER PRACTICE

BY R. E. CUNNINGHAM
Superintendent of Electrical Distribution
Southern California Edison Co

The necessity for furnishing electric service to the rural and semi-suburban districts of Southern California, on account of the scattered load and the distances to be covered, has compelled the Southern California Edison Company to adopt 11,000 volts for primary circuit. With such voltage it is possible to distribute considerable load over a wide territory with moderate sized conductors and give good regulation.

Originally lines were extended principally for supplying power for pumping plants, but in more recent years there is a large demand for lighting and power for cooking and heating purposes.

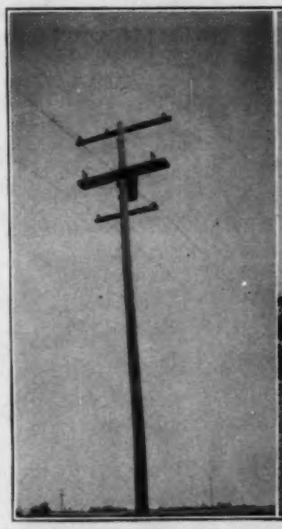


Fig. 1. Single-Phase Transformers for 11,000 Volt Lines

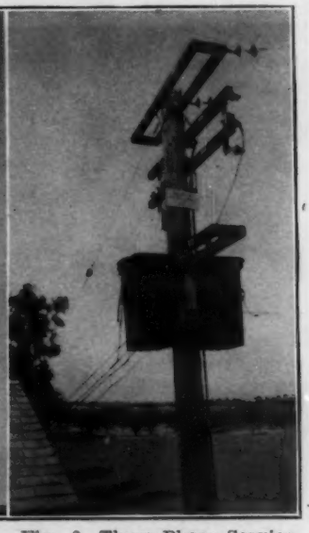


Fig. 2. Three-Phase Service for 11,000 Volt Lines

The present system includes 753 miles of 11,000 volt construction with 2400 transformers, ranging in size from 2 to 100 kilowatts. The methods of construction are much the same as used for 2200 volt lines with the addition of greater clearances and increased insulation. The proper protection of transformers and branch lines has been much the same vexing problem as with the 2200 volt system, very possibly to even a greater extent than on the lower voltage line on account of the higher voltage difficulties.

In more recent years we have been using the Pacific Electric Manufacturing Company's fuse holder, Cat. No. 1013 on installations of single-phase transformers for light, heat and small power service. The fuse consists of a Bakelite tube ¾ in. in diameter, 12 in. long, with metal cap at each end to which aluminum fuse wire is attached and led through the center of the tube. Tubes are filled with plaster of paris or other fire resisting powder. Some of the Schweitzer & Conrad liquid type fuses have been used but considerable trouble was encountered with them on account of the fact that glass tubes were easily broken and also due to the tension of the spring the fuse would break without other cause. We have occasional burn-outs with the Bakelite tube fuses, but a reasonable amount of trouble must be expected with any type of fuse protection, and greater expense for more reliable type of protection for single-phase loads we believe would be unwarranted.

Fig. 1 shows method of hanging 11,000 volt single-phase transformer with its fuses.

For three-phase service we have used the Pacific Electric Manufacturing Company's fused pole top switch, Cat. No. 413. Such an installation is shown by Fig. 2. With this arrangement transformers can be disconnected by the consumer at times when the plant is not in operation and thus prevent unnecessary transformer core loss. In case it becomes necessary to replace one of the high tension fuses the switch is opened by the troubleman before climbing the pole so he is not called upon to work on energized apparatus. We have had many cases where one of the fuses would blow, leaving the motor operating single-phase and in some cases the burn out of the motor or transformer has resulted.

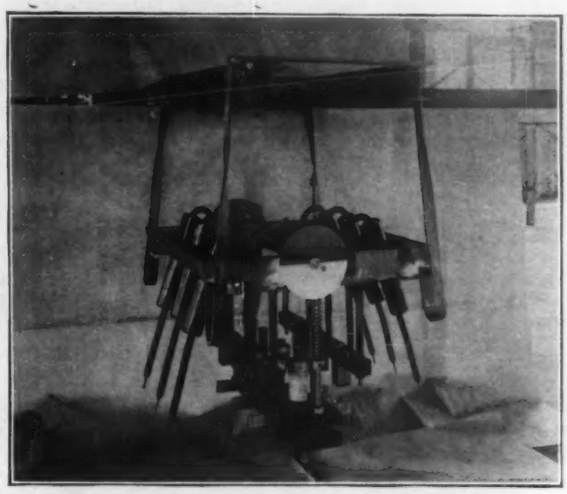


Fig. 3. Details for Three-Phase Out-door Switch

The cost of fuse renewals and the expense of troublemen and transportation in taking care of these troubles is a considerable item in a year's operation. On account of these disadvantages we have arranged with one of the local manufacturers to make for us an automatic outdoor type three-pole oil switch for use on three-phase power installations. The details of construction of this switch are shown by Fig. 3 and 4. The dimensions of the oil tank are, width 12¾ in., length 20 in., depth 17 in.

It will be noted that the switch is of simple design, having few moving parts and three series trip coils mounted directly on the switch blades. The advantage of this type of protection is that it is impossible for motor to run single-phase, as trouble in any wire of the three-phase circuit will operate the overload relay and disconnect the three poles of the switch The switch is mounted at the top of the pole as shown in Fig. 5, and it will be noted that the arrangement is such as to allow a very convenient arrangement for connecting to line and transformer terminals. Switch is controlled manually from the ground by two flexible cables operating a pulley wheel in the top of the switch case. There is an indicating dial on one side of the switch to show definitely when switch is open and closed. Disconnection lugs are placed on next adjoining pole. See Figs. 6, 10 and 11.

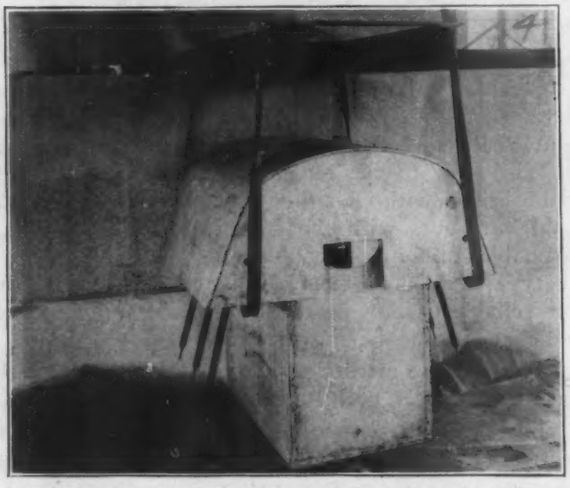


Fig. 4. Out-door Three-Phase Switch, Exterior View

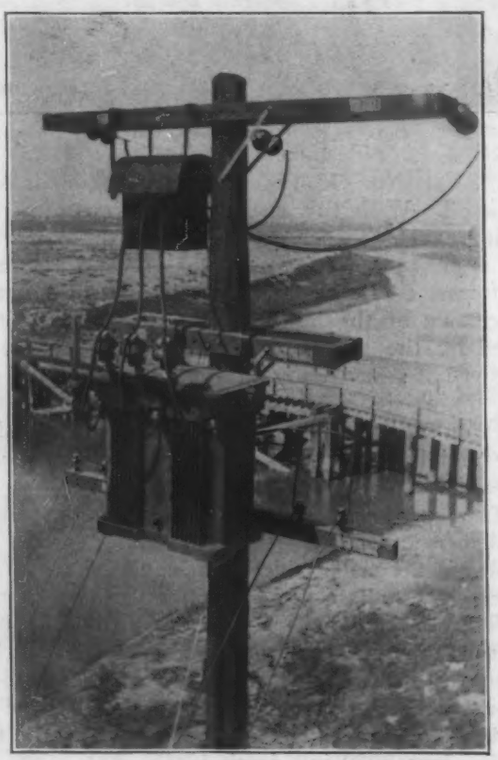


Fig. 5. Pole Mounting for Out-door Switch

We have had a number of these switches in operation in the past six months with entire success. The switch shown in Fig. 5 is within a mile of our Long Beach steam plant and connected directly to the 11,000 volt circuit, feeding from the generator bus bars with almost unlimited capacity in case of short circuit.

At this time we wish to report our experience with the use of three-phase, 11,000 volt distribution transformers. The use of three-phase transformers in large units for main station and substation installations has become a common practice, but three-phase transformers in small units for distribution purposes have not come into very general use in this part of the country. This no doubt is accounted for by the fact that a three-phase transformer can only be best used where strictly a power load or other balanced three-phase load is to be supplied.

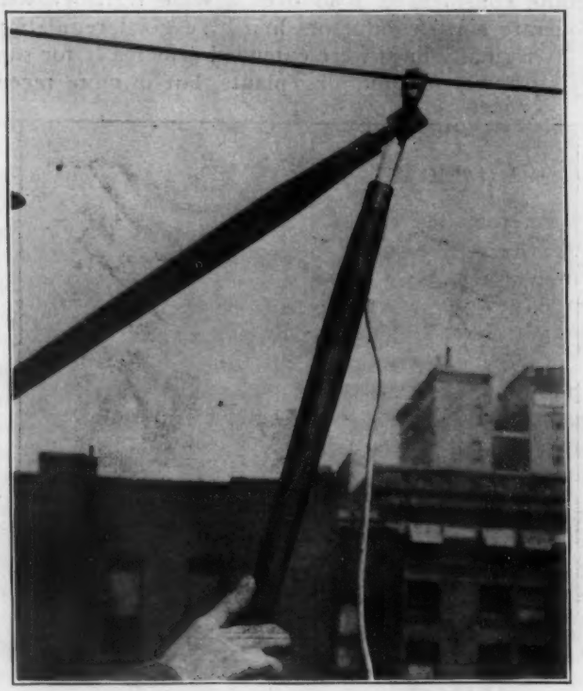


Fig. 6. Disconnection Lugs and Handles for Their Operation

We have been installing three-phase 11,000 volt transformers for power service for the past two years and have 53 now in service. On account of the ease of installing and other advantages explained later, we have decided to standardize on their use as far as possible on all future installations for power supply in units from 10 to 100 kilowatts.

When it was decided to employ these three-phase transformers considerable study was given to the choice of winding to be used. We finally selected a design having a YY winding; certain taps were desired on the high tension side of the transformer as well as double voltage arrangement for the secondary side of the transformer, and the YY winding allowed these arrangements in the simplest manner. Shown in Fig. 7 is the arrangement of connections. The high ten-

sion winding is ungrounded while the neutral point of the secondary is grounded as a safety measure. The usual connection on the secondary coils is for a 460 volt service, although two secondary coils are provided on each leg of the transformer so that a 230 volt service can be obtained if desired. With a ground at the neutral point it is impossible to obtain a voltage in excess of 266 from any secondary line wire to ground.

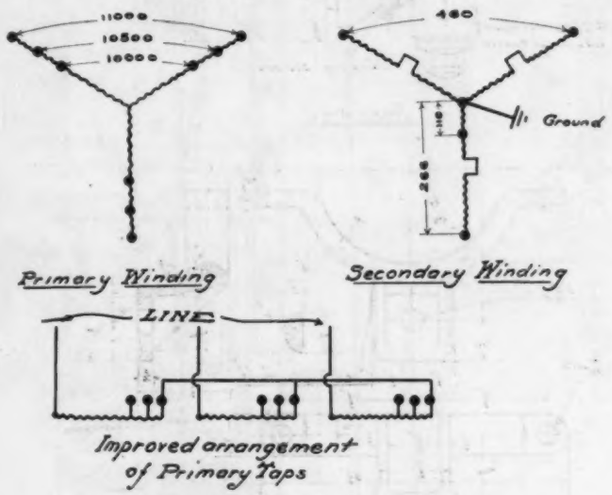


Fig. 7. Connections for Three-Phase Transformers

In most cases a few lights are required around the pumping plant and to furnish this service a tap is brought out from the winding on one leg of the transformer to supply 110 volts as between it and the ground connection.

We have had two cases of burn-outs with these three-phase transformers. In each case the burn-out was caused by an error in connecting the high tension winding, the transformer being allowed to operate with different taps, thus throwing unbalanced load on the secondary winding. In each case, however, the transformer operated for a number of months before breaking down. To avoid any possibility of wrong connections on the primary taps, we have arranged for future transformers to be delivered with the taps brought out on the neutral end of the windings as shown in the lower diagram of Fig. 7. With this arrangement it is impossible to obtain a wrong connection on the taps, as a common bar is used to connect the three taps.

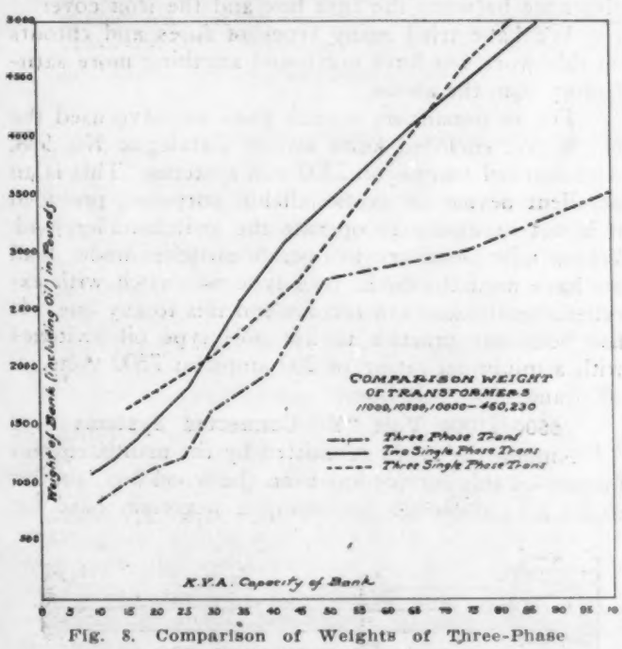

Weight of Bank (including Oil) in Pounds
COMPARISON WEIGHT OF TRANSFORMERS
11000, 10500, 10000 - 460, 230
Three Phase Trans
Two Single Phase Trans
Three Single Phase Trans
K.V.A. Capacity of Bank

Fig. 8. Comparison of Weights of Three-Phase with Single-Phase Transformers

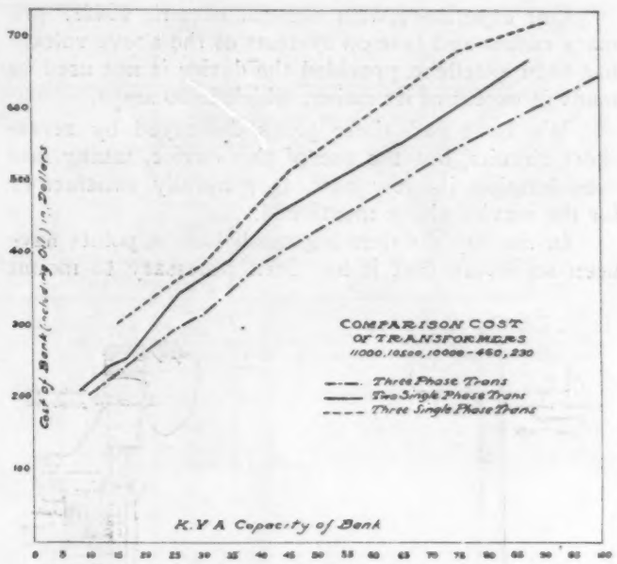

Cost of Bank (including Oil) in Dollars
COMPARISON COST OF TRANSFORMERS
11000, 10500, 10000 - 460, 230
Three Phase Trans
Two Single Phase Trans
Three Single Phase Trans
K.V.A Capacity of Bank

Fig. 9. Comparison of Cost of Three-Phase with Single-Phase Transformers

A comparison of the weights of three-phase transformers with two or three single-phase transformers for equivalent capacity is interesting. Such a comparison is shown by the curves of Fig. 8. The data for these curves is from General Electric transformers and include weight of oil. Correction has been made in case of two single-phase transformers to allow for the decreased capacity of the open delta connection. The saving in weight of transformers is worthy of consideration as it affects the cost of transportation and handling, as well as the strength of supporting pole to be provided.

Comparison of cost of three-phase transformer with equivalent capacity of two or three single-phase transformers is given by curves on Fig. 9. These costs are also for General Electric transformers and are 1916 prices and do not cover the recent increase which I understand has taken place in transformer prices. The cost of two single-phase transformers has been corrected to take care of the decreased capacity of the open delta connection. It will be noted that there is a considerable difference in costs in favor of the three-phase transformer and no doubt if other companies would adopt the use of these transformers so that they would come into more general production at the factory, the difference in cost would be further increased.

In Fig. 10 on the following page is illustrated the method of clamping the terminal to a 10,000 volt line, while Fig. 11 shows how the clamps and automatic oil switches are attached to the transmission lines.

NOTES ON SWITCHES AND FUSES

BY S. J. LISBERGER

Superintendent of Electrical Distribution
Pacific Gas & Electric Co

2300/4000 "Y" Connected Systems

Our experience with General Electric 104227 primary cutout and fuse on systems of the above voltage has been excellent, provided the device is not used on loads in excess of its rating, which is 30 amps.

We have had these plugs destroyed by severe short circuits, but the use of this device, taking into consideration its low cost, is generally satisfactory for the service above mentioned.

In the bay districts fog conditions at points have been so severe that it has been necessary to mount

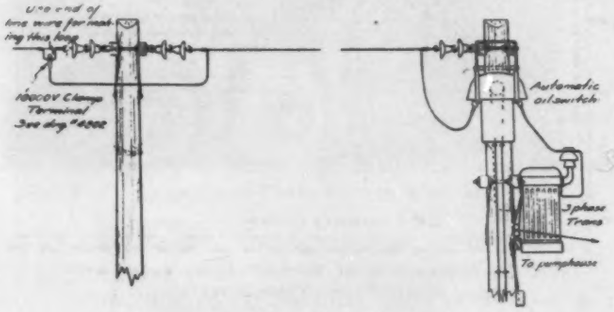


Fig. 10. Method of Clamping Terminal to 10,000 Volt Line

this on an insulator, as shown in Fig. 12. It might be of interest to note that we have used the safety plug puller as indicated on Fig. 13 very effectively on our system. By using this puller it is unnecessary for the man to put his hand anywhere near the fuse, either in inserting or pulling out the plug.

We have experienced more or less trouble with the fuses furnished for these cutouts in the smaller sizes. There appears to be a certain corrosive action between the composition fuse material and the screw terminals. We have been endeavoring to have the manufacturer build a fuse that would withstand this corrosive action. We have some of these fuses under test and the problem is apparently being solved.

The 100 amp. 2500 volt General Electric Cat. 5696 expulsion fuse has operated satisfactorily on our sys-

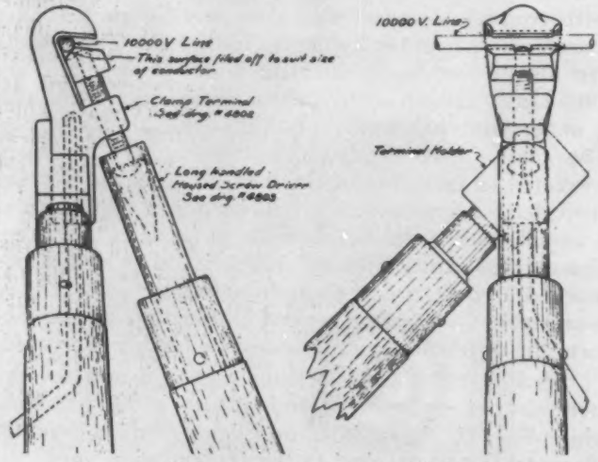

10000V Line
This surface filed off to suit size of conductor
Clamp Terminal See dwg. #4802
Long handled Hooked Screw Driver See dwg. #4803
10000 V. Line
Terminal Holder

Fig. 11. Clamps and Automatic Oil Switches on Transmission Lines

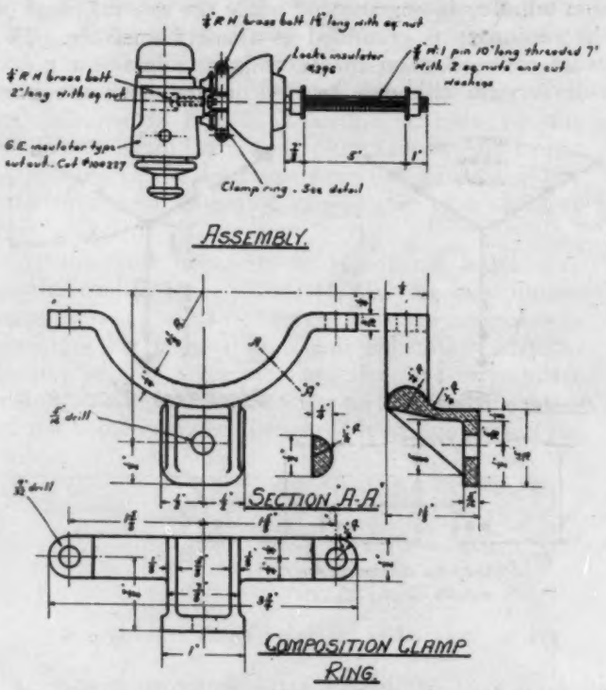


Fig. 12. Switch and Fuse Mountings in San Francisco Bay Region

tem where the amperage does not exceed 100, except in the districts in the immediate vicinity of San Francisco bay, where fog and dust is encountered. These cutouts are dangerous under this condition, as the fog and dirt collects inside the box so heavily as to ground the conductor to case.

Satisfactory operation of these away from the fog districts has been obtained, provided they have been limited to current, not to exceed 100 amps. This type of fuse, in my opinion, could be modified so as to make it a more effective device. The main faults are contacts not ample for the current and insufficient clearance between the fuse box and the iron cover.

We have tried many types of fuses and cutouts on this work but have not found anything more satisfactory than the above.

For sectionalizing branch lines we have used the D. & W. enclosed knife switch Catalogue No. 938, with marked success on 2300 volt systems. This is an excellent device for sectionalizing purposes, provided it is not necessary to operate the switch under load. Where it is necessary to operate switches under load we have used the G. E. pole type oil switch with excellent results and can recommend this to any one. It has been our practice to use pole type oil switches with a minimum rating of 200 amps. at 7500 volts on 2300 and 4000 volt lines.

6600/11000 Volt "Y" Connected Systems

Among the types submitted by the manufacturers for use on this service has been the wood box, similar to G. E. Cat. 44304 containing a porcelain base for

Fig. 13. Safety Plug Puller for San Francisco Bay Region

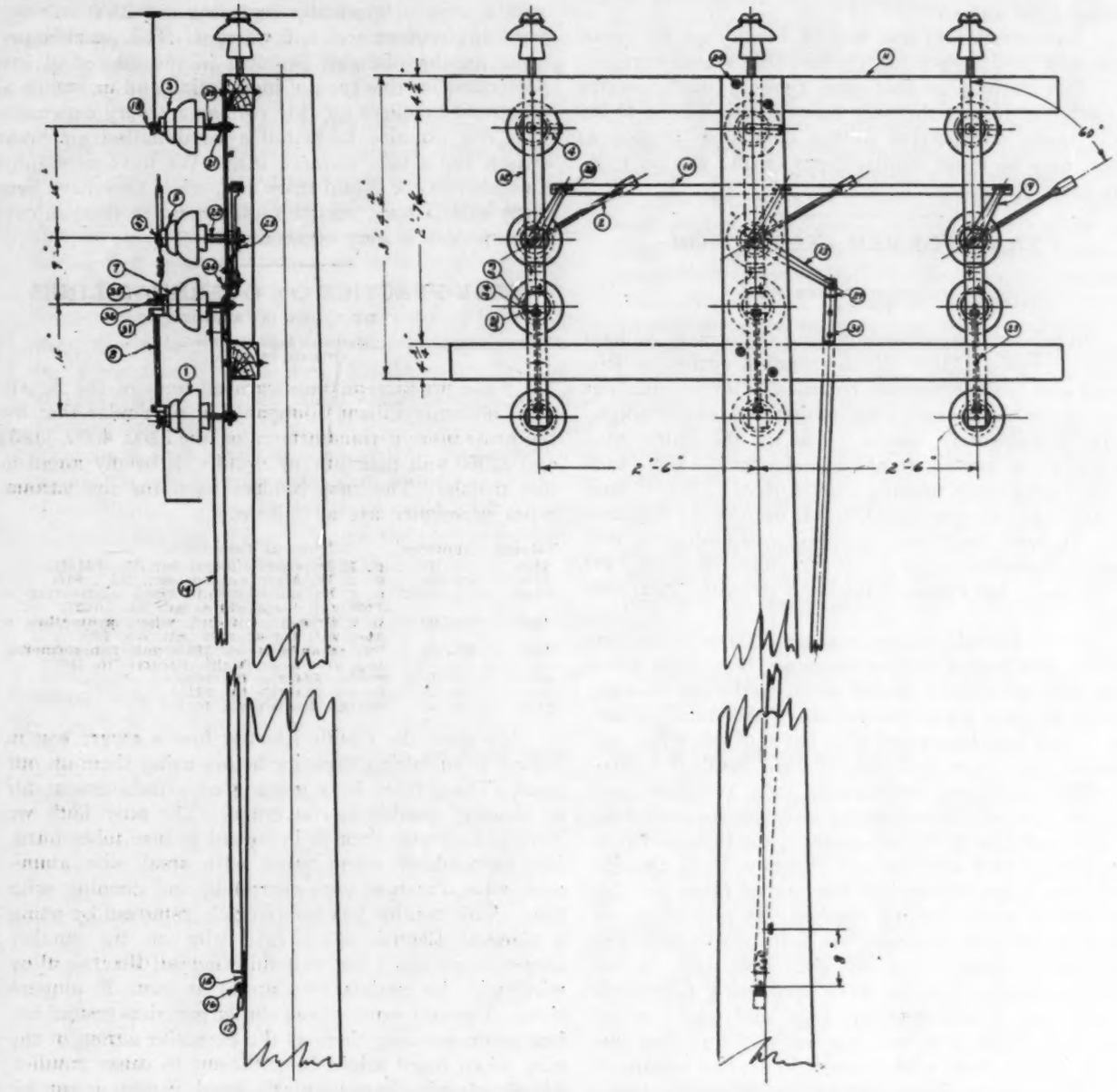


Fig. 14. Combined Switch and Fuse Developed by Pacific Gas & Electric Company

holding expulsion fuse. These boxes have hinged covers, insulating entrance bushings, etc. Our system has burned up every type of box presented and the accidents have been so severe that we have removed practically all of these boxes. Usually the box burns, setting fire to the crossarm and dropping the live wire to the ground.

I am opposed to any box, wood or iron, of this type, because it is customary to mount the fuse box above the transformer, and in order to disconnect or replace a fuse, the lineman must climb past hot wires in order to reach the fuse with a stick. In disconnecting the device it is necessary to open one fuse at a time, also our experience has been that the lineman usually forgets to carry the stick with him and attempts to operate the device by some more dangerous means.

Satisfactory operation under conditions prevailing in the West can be obtained by the use of a combined switch and fuse, similar to that shown on Fig. 14; this being a switch and fuse developed by the Pacific Gas & Electric Company and successfully used on its system.

The device consists of a combined disconnecting switch and fuse manually operated from the ground, enabling the lineman to climb the pole and replace a fuse without any hazard. It opens all three legs at once and thus does away with any hazard of a man ascending a pole to replace one fuse when the other two legs are hot. The device is simple in operation, inexpensive and has given satisfaction in the many hundreds of cases where it has been used.

The fuse consists of a wire encased in a glass or porcelain tube, held between two clips by means

of screw clamps. These in turn fit into the insulators, forming the support.

The switch and fuse mount directly on the cross-arm and pole supporting the line and transformers.

Our feeling is that this type of disconnecting switch and fuse is the only safe type to use on 11,000 volt work, irrespective of the details of design, as there may be other similar types on the market to do the same thing.

TRANSFORMER PROTECTION

BY C. O. POOLE

Chief Engineer, Southern Sierras Power Co

In reference to protection for transformers we have what we call a 33,000 volt distribution system in Riverside and San Bernardino counties. Our practice has been, up to the present time, to install banks of single-phase transformers, outdoor type, in the center of a section to be served, stepping down from 33,000 volts to 2300 volts; then running a network of 2300 volt lines to which are connected 2300 volt motors, 15 h.p. and over. In some cases we supply 440 volt motors by furnishing individual step-down transformers from 2300 to 440 volts, but measure the current on the 2300 volt side.

In our Nevada district we use 6600 volts for our general distribution system, stepping the voltage down from 6600 to 440 for motor service. In the Nevada district we have made general use of the standard cast iron Noark fuse boxes and they have proven quite satisfactory, but quite often one of these boxes is burned up, with consequent fire hazards, etc. We have used the pole type, oil disconnecting switches for switching our 6600 volt line in Nevada district, and these switches have proved very efficient and effective. Upon general principles, I am opposed to the use of fuses for this distribution work and my tendency is toward an oil circuit breaker for this purpose, both on the 6600 and 2300 volt systems. On our 2300 volt lines in the Southern district here we have been using the standard cast iron Noark fuse box type, and we have had cases of a single fuse blowing out and throwing our system single-phase with damage in several instances. This danger alone, in my estimation, is sufficient reason for abandoning the fuses in favor of three-pole circuit breakers, to say nothing of other advantages that would be gained thereby.

For an ordinary bank of transformers,—we use a set of 3-100 kw. transformers,—the cost of a circuit breaker would be about $60 as against $20 for a set of Noark boxes with fuses. These fuses, as you are aware, blow out quite frequently and if several of them blow out during the season the expense would easily justify the difference in cost in favor of the circuit breakers. It is our practice at this time to install circuit breakers in preference to the fuses on our larger size of transformer banks. It is my recommendation that this practice be pursued and hope that the manufacturers will be able to produce a less expensive circuit breaker to serve the purpose for smaller installations.

In connection with the subject, it might be of interest to know that we are now endeavoring to standardize our rural practice by utilizing three-phase transformers, stepping down direct from 33,000 to 440 volts, with a view of gradually replacing our 2300 volt systems as circumstances will warrant. This practice presents another difficult problem in the matter of fuse protection for this type of installation and inasmuch as oil circuit breakers for this voltage are very expensive, it is our practice to install a combination air break switch and a tube covered fuse. We have used quite a number of the liquid fuses and, while they have been fairly satisfactory, yet the replacement of them in case of blow outs is very expensive.

FUSE PRACTICE ON OVERHEAD LINES

BY JOHN A. KOONTZ

Electrical Engineer, Great Western Power Co

Fuse practice on the overhead lines of the Southern California Edison Company, in particular that for the protection of transformers on the 2200, 4000, 11000 and 22000 volt distribution circuits, is briefly noted in this article. The fuse holders used for the various types of service are as follows:

Voltage	Amperes	Type of fuse holder
2200	1- 25	G. E. Primary cut-out cat. No. 104227.
2200	30-100	G. E. Primary cut-out cat. No. 5696.
4000	1- 25	G. E. Primary cut out when portecting a 2200 volt transformer cat. No. 104227.
4000	30-100	G. E. Primary cut-out when protecting a 2200 volt transformer cat. No. 5696.
4000	25-100	For secondaries of 22000 volt transformers, 4000 volt lines Pacific Electric No. 1013.
6600	3- 50	Pacific Electric No. 1035.
11000	3- 50	Pacific Electric No. 1035.
22000	3- 30	Pacific Electric No. 1035

We gave the Pacific Electric fuse a severe test in regard to rupturing capacity before using them on our lines. These fuses have given good satisfaction as far as clearing trouble is concerned. The only fault we have to find with them is in regard to fuse tubes burning, particularly when fused with small size aluminum wire, the fuse wire corroding and opening with time. This trouble has been largely removed by using a General Electric alloy fuse wire on the smaller ampere sizes, but I feel that this General Electric alloy wire will be satisfactory up to at least 20 ampere sizes. I would want to see the larger sizes tested before recommending them as the explosive action of the wire when fused might be sufficient to cause trouble. Aluminum wire is particularly good, in that it can be oxidized with a small amount of explosive violence. We have been looking the market over for a fuse tube that would have the mechanical and dielectric strength of micarta or bakelite, and still be fire-proof. If we could obtain such a material, we feel the fuse situation would be practically solved.

Regarding the action of these fuses on heavy loads on 22,000 volt circuits, we have noted numerous cases in which banks of 3-400 k.v.a. transformers have been cleared when protected by 60 ampere fuses. These fuses have not only cleared local trouble on the bank, but did it without tripping the automatic breakers at the substation.

On our 11,000 volt feeder work, especially on the heavier loads, we have used in many cases a combined fuse and disconnecting switch of our own make. The fuse portion consists of an 18 in. hollow wooden tube which is fused with small copper wire. This arrangement will not give over-load protection to the apparatus, but will clear the feeders in case of defective

transformers. When protecting banks of 3-50 kw. transformers or larger, the tubes are in general thrown out of the holders, and quite often broken, but this does not interrupt the feeder, and the matter of replacing a new fuse tube is inexpensive.

Our practice is to fuse transformers at approximately double normal current, and in order to eliminate trouble from using improper size fuses, we have made up rather complete tables covering the fuse size for all standard transformers, banks and connections. For example in case we were handling a bank of 3-2200 volt 25 kw. transformers, if these three transformers were connected in "delta" on a 2200 volt line, they would be fused with 40 ampere fuses, while if the same transformers were connected in "Y" on a 4000 volt line, 25 ampere fuses would be used, and if a single transformer was connected for lighting work, 25 ampere fuses would be used, or this same size would be used if two transformers were connected in "T" or open "delta." These tables were made up to prevent a certain amount of confusion on the part of field men, and they have been found very satisfactory.

The fuse problem, as it appears to me, is one of obtaining a mechanically rugged, inexpensive and fireproof fuse holder that can be fused with small capacity wire, and used on 11,000, 15,000, 17,000, 22,000, and 33,000 volt circuits.

FUSE PROTECTION ON 2300 AND 11000 VOLT SYSTEMS

BY L. M. KLAUBER

Superintendent Electrical Department, San Diego Consolidated Gas & Electric Co

Notes on the practice of the San Diego Gas & Electric Company with reference to fuse protection of transformers and branch lines in rural distribution systems of 2300 to 11000 volts are herewith submitted.

On our 2300 volt systems (which are three-phase with neutral ungrounded) we use no fuses on branch lines. At transformer stations requiring fuses of 30 amperes capacity or less, we use General Electric porcelain plug cut-out, Catalogue No. 104227. For transformer installations requiring fuses in excess of 30 amperes we use General Electric 100 ampere 2500 volt cut-out box No. 159327 with expulsion fuse holder No. 159330[1].

The above protective devices are giving us good satisfaction. We ordinarily fuse transformers for approximately double load; that is, a fuse is chosen having an amperage approximately twice the full load primary current of the transformers. On 11000 volt service we fuse transformer stations with General Electric cut-out boxes, Catalog No. 123340, with expulsion fuse holders No. 123341. This is a box rated at 10

[1]The General Electric Company, in order to consolidate various types, may abandon Catalog No. 159327, substituting therefor 6600 volt 100 ampere cut-out box No. 106918, with fuse holder No. 106902. Upon this point they have not yet advised us definitely.

Fuse Sizes for Three Phase Delta Connected Transformer Banks

Size KW.	Volts 110	Cat. No.	220	Cat. No.	44	Cat. No.	2200	Cat. No.	6600 G.E. alloys	11000 Fuse	22000 Wire
1	25	51277	15	Wire	10	Wire	2	23175	3		
1.5	40	51279	20	Wire	10	Wire	3	23176	3		
2	50	51280	25	51277	15	Wire	3	23176	3		
2.5	60	51281	30	51278	20	Wire	5	23178	3	3	
3	75	51283	40	51279	20	Wire	5	23178	3		
4	100	66435	50	51280	25	51277	5	23178	3		
5	130	66441	60	51281	30	51278	10	23179	3	3	3
7.5	190	66453	100	66435	50	51280	10	23179	3	3	
10	250	66465	130	66441	60	51281	15	23180	5	3	3
15	380	66495	190	66453	100	66435	25	23182	10	5	3
20	500	66527	250	66465	130	66441	30	9425	10	5	3
25	600		320	66479	160	66447	40	9426	15	10	5
30	600		380	66495	190	66453	50	9427	15	10	5
40	1000		500	66527	250	66465	60	23157	20	10	5
50	1200		600		320	66479	75	9428	25	15	10
75			1000		470	66521	100	9429	40	25	10
100			1200		600		125		50	30	15
150											25

Fuse Size for Open Delta Connected Transformers, Star Connected Transformers, "T" Connected Transformers, Single Phase Transformers

Size KW.	Volts 110	Cat. No.	220	Cat. No.	44	Cat. No.	2200	Cat. No.	6600 G.E. alloys	11000 Fuse	22000 Wire
1	20	Wire	10	Wire	5	Wire	1	23174	3		
1.5	20	Wire	15	Wire	10	Wire	1	23174	3		
2	30	51278	20	Wire	10	Wire	2	23175	3		
2.5	40	51279	25	51277	10	Wire	2	23175	3	3	
3	40	51279	25	51277	15	Wire	3	23176	3		
4	60	51281	30	51278	20	Wire	3	23176	3		
5	75	51283	40	51279	25	51277	5	23178	3	3	3
7.5	100	66435	60	51281	30	51278	5	23178	3	3	
10	150	66445	75	51283	40	51279	10	23179	3	3	3
15	220	66459	100	66435	60	51281	15	23180	5	3	3
20	290	66473	150	66445	75	51283	20	23181	5	3	3
25	360	66487	180	66451	90	51285	25	23182	10	5	3
30	440	66515	220	66459	100	66435	30	9425	10	5	3
40	600		290	66473	150	66445	40	9426	15	10	5
50	700		360	66487	180	66451	50	9427	15	10	5
75	1000		550		270	66469	70	23158	25	15	10
100			700		360	66487	90	23160	30	20	10
150							125		50	30	15
200											20
250											25
300											30

Notes.—Above catalogue numbers are General Electric.
Above wire figures are ampere ratings of fuse wire.
Use 2200 volt fuses on this table for Star banks on 4000 v. Use 6600 volt fuses on this table for Star banks on 11000 v.
For fusing 110, 220 and 440 volt circuits, General Electric secondary cutout No. 67275, with proper size wire or fuse, shall be used.

For fusing 2200 and 2400 volt circuits, 1 to 25 ampere capacity, inclusive, General Electric primary cutout No. 104227 shall be used, with proper size General Electric fuse, 30 to 100 ampere capacity shall be protected with General Electric fuse box No. 5696, with proper size fuses.

amperes and 15000 volts, but we use it up to 20 amperes at 11000 volts. We found the boxes as put out by the manufacturers inadequate to our service; consequently we purchase the fittings and make up in our own shops, heavy poplar boxes to contain them. Transformers are ordinarily fused from 50 to 75 per cent overload. As a matter of fact these fuses, like all other fuses of this type, give little protection against overloads, but give fair protection against short circuits. Where a branch line is installed to serve a single customer these fuses are usually located at a point where the branch is tapped to the main line, rather than at the transformer.

For the protection of the longer branch lines we are installing Pacific Electric switch No. 1420-F. We find that these give good protection except that the cartridges almost invariably burn up when the fuse blows. In one of our districts, in the place of General Electric cut-out boxes for transformer fuses, we are using Pacific Electric switch No. 427-F mounted vertically. These take the same uses as No. 1420-F. They appear to give good service and have the advantage over the cut-out boxes that the entire installation can be killed by means of an extended operating rod before the troubleman begins to climb the pole, consequently it is not always necessary to send out two men when a fuse is to be renewed.

We are using three-phase transformers on suburban 11000 volt lines in the place of former open delta banks and find them greatly to be preferred to single-phase transformers, in that they reduce the cost of installations and the hazard due to the simplicity of the wiring on the pole.

Like all other companies we have from time to time been bothered by single fuses blowing on three-phase lines, thus leaving various small motors running single-phase until they burned out. We have looked the market over for 11000 volt automatic oil switches for out-door service, but have not been able to locate anything. We have been informed that the Pacific Electric Manufacturing Company has now in process of development and almost ready for the market, a combination oil and air break switch with which you are familiar. This may solve our difficulties on the larger 11000 volt transformer stations, but on stations of 300 k.v.a. and over we have found fuses very unsatisfactory. We are also trying out a Bowie automatic air break switch on a 600 k.v.a. station, but this has not been installed long enough to give us an indication as to whether it will be satisfactory.

FUSE PROTECTION ON DISTRIBUTING LINES

BY E. A. QUINN
General Superintendent, San Joaquin Light & Power Corporation

The 10 kv. feeders from substations of the San Joaquin Light & Power Corporation are protected by a 3-pole General Electric K-12 automatic oil circuit breaker connected into circuit through three series transformers. All branch lines are taken off the main feeder through a 3-pole single disc K.P.F. pole top air switch. All taps to transformers are protected through three "disconnects," made at the company shop, the use of which over an experience covering several years has proven very satisfactory.

An illustration showing the essential features of these disconnects is attached hereto. It will be noted that on the cross-bar holding the fuse is attached, in the center, a standard 10 kv. insulator. The cross-bar is removed from the clips, for re-fusing or disconnecting, by means of a five foot stick threaded on the end, which is screwed into the insulator. The operator does not come at all close to live parts. There are in service in this company approximately 15,000 of these disconnects, and very little trouble has been experienced from them. About the only trouble experienced is the burning of the cross-bar during wet weather, when the fuse has blown. However, this percentage is small. The total number of cases of this nature during a season is well under 30.

We are now experimenting to find a material which will not burn, although wet with the fuse out. One objection to the use of the "disconnect" is the fact that one leg of the circuit is opened, and not all three legs together. The cost of three of these disconnects f.o.b. our storeroom is $5.78.

We install at intervals of two or three miles, or at some convenient point, an air break K.P.F. switch, and as almost all our circuits are of the "loop" type we can cut out a short section of line in case of trouble without serious interruption to the whole line.

On our 2300 volt distribution all circuits are protected by automatic oil circuit breakers at the substation. Pole top oil switches are used for sectionalizing the line. All transformers are protected by General Electric plug cut outs. Our fusing table for 2300 volt transformers is as follows:

k.v.a.	Fuse Amp.	k.v.a.	Fuse Amp.	k.v.a.	Fuse Amp.
1	1	7½	5	30	20
2	1	10	6	37½	25
3	2	15	10	40	30
4	2	20	15	50	30
5	3	25	15		

We have considered various makes of three--pole fuses, or a combination switch and fuse, but the expense of these is so great in comparison to the 6600 volt disconnects which we are using that we have decided to continue the use of our own disconnect.

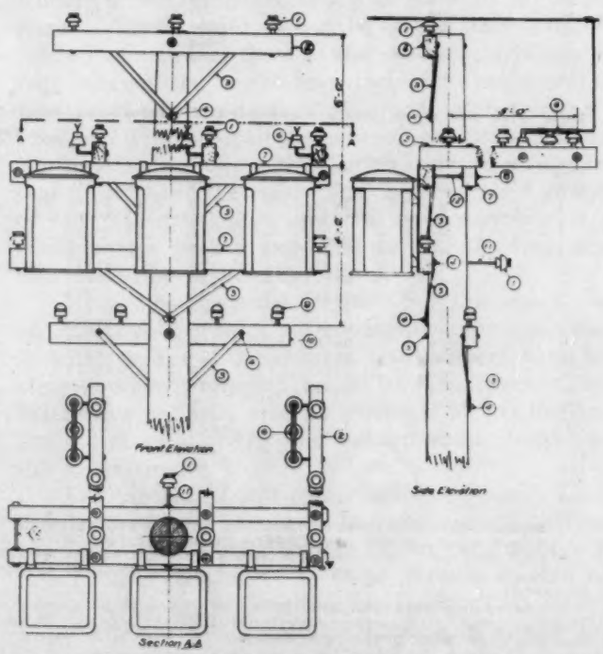


Fig. 15. Suburban Transformer Structure on Transmission Line Pole

STANDARDIZATION OF THE HARDWARE FOR CLEVIS CAP SUSPENSION INSULATORS

BY L. M. KLAUBER

Superintendent Electric Distribution, San Diego Consolidated Gas & Electric Co

Scope.—This report has for its purpose a consideration of the dimensional standardization of the hardware of clevis cap suspension insulators. Insulators having hook caps, eye caps or various patented methods of linking, will not be considered, nor will the respective merits of these several types be discussed.

Necessity for Standardization.—The clevis cap strain insulator as a unit has become a standard appliance in line construction practice. Not only is it used extensively in the construction of transmission lines, but it plays an important part in the installation of high voltage transformers, lightning arresters and switch gear at generating and substations. Many auxiliary fittings, such as tower links, suspension clamps, strain clamps and strain yokes have been placed on the market especially for facilitating the use of these insulators. It is obvious that standardization is essential in order that units may be interchangeable and that supporting links and fittings may be used with any line of clevis cap insulators.

In the past there has been a wide variation, not only in such details as the width and depth of clevis, but in such essential elements as the diameter of the bolt and the hole in the stud. Often the styles of a single manufacturer have not been similar or interchangeable. In consequence, many operating companies, having once adopted a unit with auxiliary hardware, have been prevented from taking full advantage of improvements in type, or have been required to district their systems, carrying separate lines of renewal parts for each district or transmission line.

In order to indicate the non-interchangeability of present types, we present herewith Table I:

Table I

	A 1	A 2	A 3	B 1	B 2	C 1	C 2
A 1	Yes	No	No	No	No	Yes	No
A 2	Yes	Yes	Yes	No	Yes	Yes	No
A 3	Yes	Yes	Yes	No	Yes	Yes	No
B 1	Yes	Yes	Yes	Yes	Yes	Yes	Yes
B 2	Yes	Yes	No	No	Yes	Yes	No
C 1	Yes	Yes	No	No	Yes	Yes	No
C 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes

In deducing this table we have taken at random two or three standard styles of insulators manufactured by each of three companies. These have been given type numbers, A 1, A 2, etc.; similar letters indicating the product of a single manufacturer. We have endeavored to fit these insulators together in pairs in all possible combinations, with the result shown in the table. In reading the table it should be noted that in any combination the insulator in the top row was placed above that indicated at the left; that is, the stud of the insulator in the top row was connected to the clevis of that in the vertical column. It will be noted that connections could not be made in 15 out of 49, or 30.6 per cent of the combinations. Several of the combinations which have been considered possible, were made with such difficulty that they would not be feasible for field work.

Present Status of Standardization.—On November 27, 1916, representatives of three of the insulator manufacturers met in New York with representatives of one of the largest of the engineering and operating companies and determined upon a manufacturers' standard clevis type connection for suspension insulators. Through the courtesy of the officials who attended the conference we have been furnished with the details of the standard agreed upon, as shown herewith in Fig. 1.

It was at first thought that this conference and the standard agreed upon would obviate the necessity for further deliberations by your committee. However, after a study of the new standard, its interchangeability with older designs, and its use with existing hardware and fittings, it has been deemed advisable to bring the matter before this meeting for discussion.

The following quotation from a letter from one of the operating engineers who attended the conference will explain the scope of the adopted standard:

"In view of this great variety of clevises which previously have been put out, it will be appreciated that it was entirely futile to attempt to provide a clevis which would be fully interchangeable with the entire lot, although it happens that it will be possible to make replacements by shifting all of the old units to one end or the other of the insulator string as may be required. The manufacturers have agreed with us that the form and dimensions shown would seem to be the most satisfactory that can be arrived at from the standpoints of weight, strength and reasonable interchangeability with the older forms.

"Consideration was given to the developing of a clevis along the lines of considerably greater strength, so that it would be suitable for practically all uses, but it was decided that the demand for high strength insulators was not sufficient to justify the increase in weight and dimensions in hardware for the 10 in. disc insulator as ordinarily used. It is pretty fairly agreed that they should not be used for loads exceeding 3000 pounds. The standardization of a large clevis for heavy duty insulators may prove to be advisable, and the manufacturers mentioned have this possibility in mind."

Of primary importance in connection with this new standard is the adoption of the ½ in. bolt. While it is a fact that this bolt has a strength exceeding that of the porcelain of the insulator and is subject to little wear or corrosion, nevertheless the adoption of this standard has rendered the new unit less interchangeable with the older designs, a majority of which were equipped with ⅝ in. bolts. The new standard is substantially the same as the type referred to as B 1 in Table I. (B 1 and C 2 are the only types having ½ in. bolts, the rest having ⅝ in.). It will be noted that owing to the 9/16 in. hole in the stud, B 1 will fit above B 1 and C 2 only, although it will fit below all. To fit one of the new standard insulators into an old string having ⅝ in. bolts, the new member must either be placed at the bottom of the string or the pin of the next lower number must be changed to ½ in., which effects a rather loose connection. Even if placed at the bottom of the string it will be necessary to replace the bolt of the suspension or strain clamp with ½ in. bolt unless already so equipped.

But a matter which cannot be so easily remedied is the condition at the tower end of the string. Obviously, if the ring, stud or punched member at the tower has a thickness in excess of 9/16 in. the new standard insulator cannot be attached without the interposition of an S-hook, or other connecting link, and in future ⅝ in. eyebolts must be replaced by ½ in.; for not only are the clevis wings on the new stand-

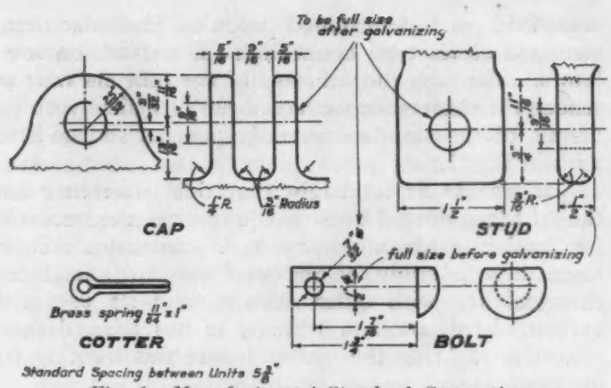


Fig. 1. Manufacturers' Standard Connection for Suspension Clevis Type Insulator

ard too close together to permit the entrance of a 5/8 in. eye, but the depth of clevis below the bolt is too shallow for a 5/8 in. part. This is of especial importance where the insulator is attached directly to a punched member, since great accuracy will be required in spacing the hole correctly from the end of the member.

Suspension insulators of this type are constantly growing in favor for use in high voltage distribution work (6600-33000 volts) at deadends and at corners. In wood pole lines of this nature the 5/8 in. bolt is largely standard for through bolts, space bolts, etc. It has been the practice with most companies to use 5/8 in. eye bolts, U-bolts or eye nuts in this work for the attachment of strain insulators and with the new standard this will no longer be possible. Furthermore, in work of this type the strain clamp is usually omitted, the line wire being attached directly to the stud of the insulator protected by a thimble. With 9/16 in. hole a 3/8 in. thimble is the largest which may be used, and this will tend to cramp the larger conductors.

In view of these facts it is questionable whether the choice of the 1/2 in. bolt and the limitation of the use of the clevis to 1/2 in. line hardware is justified. A fitting base on 5/8 in. hardware is interchangeable with 1/2 in. insulators or fittings (if the 5/8 in. bolt be replaced with a 1/2 in.) so that such an insulator can be used at any point where a 1/2 in. base can be used and in many cases where it cannot. Thus while the 1/2 in. bolt is justified on the score of strength and first cost, it is not so desirable on the score of interchangeability, and the latter should, we believe, receive first consideration.

Whatever the ultimate decision in regard to the size of bolt, the distance from the lower edge of the hole to the bottom of the clevis (17/32 in.) is open to question. This should be made 1/16 in. greater to permit of variations, not so much in adjacent insulator studs, but in tower supporting links. The square edge of the stud would still be sufficient to prevent porcelain parts of adjacent units from striking when being hoisted into place or when swinging in service, which is all that is required. The increase in total length of unit will be unimportant. It would be inadvisable to correspondingly increase the distance from the lower edge of the hole to the bottom of the stud, as this would frequently render impossible, interchangeability with existing units.

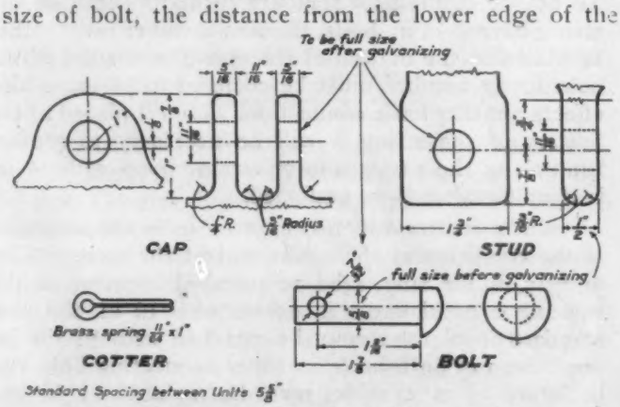


Fig. 2. Suggested Standard with 5/8-in. Bolt

Alternative Standard.—With these facts in mind we offer for discussion an alternative design, having a 5/8 in. bolt as a basis. This is shown in Fig. 2. Such a design might either be adopted as a universal standard, or as a standard for high strength units. We likewise show in Fig. 3 comparative side views of the adopted 1/2 in. standard and the suggested 5/8 in. standard to show clearances.

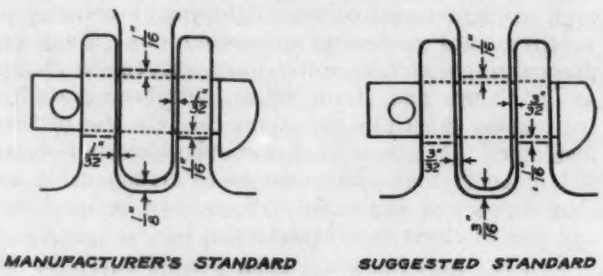


Fig. 3. Comparative Clearances of Manufacturers and Suggested Standards

SOME NOTES CONCERNING THE JOINT USE OF POLES

BY J. E. MACDONALD

Secretary, Joint Pole Committee, Los Angeles, Cal

Essentials of Agreement.—The function of a joint pole agreement is to provide a method whereby the number of poles occupying streets, highways, and other public places may be reduced to a minimum. With no other obligation than "to play the game on the square," the Los Angeles public service corporations have been operating under such an agreement for over ten years, during which time approximately 80,000 poles have been involved by its terms and conditions. The collaborators only knew the results which it was desired to accomplish by the agreement and "intent and purpose," rather than "ways and means," constitute its dominating features. It was the intent and purpose to eliminate all superfluous poles as soon as practicable, yet there was no suggestion in the agreement that joint construction should be obligatory in any case. To make joint construction mandatory by agreement, would in effect be the same as a self-imposed ordinance requiring the reconstruction of overhead lines regardless of the merits of each case. Briefly stated, an agreement should set forth in detail its purpose, specify certain rates for joint use, and formulate general rules governing equitable adjustments for all cases of construction and reconstruction which are likely to arise in prac-

tice. The administration of the agreement, manner of making repairs, renewals, reconstruction, or changes in location of joint poles, limitation of attachments, maintenance of wires and cables, termination of joint ownership, salvage, rights of way, taxation, and liability are all important items which should be fully covered to conform to the requirements of local conditions. A general specification covering joint construction methods is desirable. Such specification must not conflict with any legal requirements of state or municipal authorities.

Application of Agreement.—Various methods may be adopted for making the agreement effective. Matters involving joint poles may be handled through routine channels by regular employes of the utilities affected. Where a large territory is to be covered and where there are several utilities involved, a better method is to appoint a committee, consisting of one representative from each utility. This committee should elect a secretary, who may be one of its own members and act without salary, or if the project be sufficiently large, he may be an independent employe not otherwise affiliated with any of the utilities. The duties of a committee include all preliminary arrangements for joint construction and the preparation of records in connection therewith. Any utility desiring to make a change in its pole plant, notifies the committee of its intention so to do. The committee proceeds to find out if any other utility is affected and desires to be provided for, making the necessary plans and arrangements accordingly.

Charges for Joint Use.—The joint use of poles involves the buying, selling, leasing or renting of pole facilities. Charges for joint use are usually based on the valuation of the pole set, painted and stepped, ready for installation of crossarms, wires, cables and other appurtenances. These charges may be made on the basis of joint ownership, joint use under perpetual easement, life rental, annual rental, or contact rental. As standardization is desirable, it is inadvisable to permit of an indiscriminate choice of method under one agreement. The joint ownership basis is a very effective method, which provides for the sale or purchase of an undivided share or interest in poles. This method has the slight disadvantage of requiring great detail in making appraisals for rate making or taxation purposes. Joint use either by perpetual easement or life rental is free from this disadvantage, and if rates are developed to include the proper proportion of the fixed charges, either method may obviate the necessity for much inter-company billing, such as exists under the joint ownership method. On the other hand, it is impossible to make these charges absolutely equitable. A rate which is effective for two companies is excessive on the advent of a third party, and it seems impracticable to provide for refunding on rentals owing to the endless detail which this would involve. Charges on the annual basis are open to the same objections and in addition involve an annual check which is expensive where more than two companies are concerned. A contact rental is not applicable to a general joint pole scheme, but furnishes a convenient method for a limited number of contacts in special cases. These rates should be sufficiently high to discourage their general use. All conditions considered, the joint ownership basis represents the most effective method. With the proper unit record of poles the objections to this method are negligible.

Records.—Common practice in recording joint poles comprises the preparation of a map and schedule supplementing the working agreement. Each of these supplements in itself is a contract and is executed by the parties interested. Continuous use of this system has developed its weak points and it is no longer recommended where more than two utilities are operating. It is believed that a pole is just as important a part of the plant as a meter, transformer, telephone or other piece of equipment. As such it should be considered as a unit. Each pole—joint or otherwise—should be numbered and initialled, the initial signifying original ownership. All reference to any pole should include its number and initial. Each utility should have its own complete series of numbers. In the event that it is necessary to handle recording work through a regularly organized committee, the following method has been found fairly adequate. Applications for joint use are made by pole number on regular forms provided for the purpose. If one or more of the poles applied for is already a joint pole, the previous record discloses this fact and the committee makes the segregation, referring the application to the proper parties. If the pole or poles are not of record, copies of the application are forwarded to the owning party, which furnishes complete recording data in approving the application. This eliminates the necessity for a field check on the part of the committee. Authorization for billing is covered by a bill of sale. These are issued monthly in accordance with applications which have been duly approved for the various interests involved. A card index for each pole is prepared, two copies of which are furnished each party to the transaction. One set of the cards is for consecutive file and the other is for filing according to location. The information necessary for recording is as follows: Pole Number, Location, Length, Year Set (New or Second-hand), Condition (as to Painting, Stepping, or Treating), and the joint users, with their equities and circuits. Each card contains this information together with reference to bill of sale; the basis of settlement, and the application number of the utility purchasing interest. The cards are prepared and multigraphed prior to the preparation of the bill of sale and forwarded to the interested parties for checking. Cards for subsequent transactions involving the same pole, show all preceding transactions and constitute a true and complete record. Under the unit system, billing is authorized in all cases within thirty days after the approval of an application.

Under the supplement method of recording, it is difficult to maintain a true record at all times owing to the continual changes which are taking place in ownership and replacements, which are being made from time to time. Further, the time taken to obtain the signatures of all parties to the combination is excessive. As individual replacements take place, the record is continually approximating the unit system and it therefore seems desirable to adopt this system in the initial stages of joint construction. If it ever

becomes necessary to change systems the task may be extremely onerous. When it was decided to adopt the unit system in Los Angeles there existed 14,511 supplements, which are being worked over to conform to the more modern system.

Expense.—The cost of recording must necessarily depend upon the volume of transactions. Based on average monthly transactions involving 300 poles, the cost of recording may amount to $1.25 per pole, and may not justify the existence of a committee. For average monthly transactions involving 2000 poles, the recording cost by committee should not exceed 50c per pole. In Los Angeles, the expense is pro-rated against member companies. Utilities which are not parties to the general agreement are frequently permitted to participate in joint construction and are charged 15 per cent of their equity in combinations recorded. The amount so collected is deducted from the total expense of the committee before pro-rating. This method is not essentially correct. It has been proposed that the utilities be divided in two classes—members and non-members, or members and associate members. Member companies should be assessed a fixed monthly sum and associate members should be charged a percentage of their equities in combinations recorded as heretofore. Any expense in excess of the sum derived from the fixed monthly assessments and the collections from associate members should be pro-rated against member companies in proportion to the monthly transactions involving these companies.

Results.—There are certain intangible benefits to be derived from joint construction which cannot be estimated. In 1908, the property owners on a certain street got together and demanded underground subways for all public utilities. The municipal authorities were favorable to the project and an ordinance creating the underground district was prepared. The committee became active and obtained an agreement with a majority of the property owners, agreeing to the maintenance of one joint line on each side of the street for a period of at least five years, provided that joint constructon was immediately undertaken. The proposed underground covered a distance of 9300 ft. and involved five utilities. It was possible to accomplish the reconstruction without setting any new poles, and over 300 superfluous poles were removed from this section. The property owners were so well satisfied that the underground project has been entirely forgotten, although almost nine years have passed since the signing of the agreement and part of the street is in the remote business district where underground may again become an issue at any time. A more significant result is found in the direct economies effected when two, three or four utilities occupy the same pole, dividing the investment cost and also fixed charges which amount to at least 19 per cent of the pole value annually. Another important benefit arises through the legal requirement for overhead construction, which makes it extremely difficult to comply with such regulations except through a joint use of poles. Taken therefore as an operating condition, the joint pole should be considered as an economic necessity rather than a choice of the lesser of two evils; an involuntary choice sometimes between overhead and underground construction.

Special Problems.—A large part of all combinations are effected on existing poles. Such combinations are made in a routine manner and present no unusual conditions for consideration. A small percentage presents no greater problem than the preparation of plans for the approval of the utilities affected, where it is proposed to make extensions into undeveloped territory, or to reconstruct on account of public improvements (the opening and widening of streets and changing of grades), or to reconstruct on joint poles to offset the demand for underground conduit and subways where assurance can be given that a joint pole line will be acceptable for a reasonable term of years. A small percentage involves special problems in equity, which can only be adjudicated in conference and compromise by the utilities concerned. These involve locations occupied by two or more utilities where reconstruction becomes imperative for one of them but not for the others. The existing construction of one or more of the utilities occupying this location may be entirely adequate and in first-class shape, or it may be partially or almost wholly obsolete. Certain general rules may be formulated governing such conditions, but no rule will fit all conditions which are likely to arise in practice. In general, the party through whose necessities reconstruction becomes necessary, should not be instrumental in making the conditions any more objectionable after reconstruction than before. If a joint lead of recent construction is overbuilt, it is incumbent upon the constructing party to make whatever concessions are necessary to continue the highly improved condition. On the other hand, if overbuilding the leads of one or more parties whose poles, wires, and fixtures are apparently inadequate and obsolete, the constructing party should not be called upon to make any concessions other than to set poles sufficient for the joint use of all parties occupying this location and such parties should purchase interest or easement in the usual manner. Between these extremes there are many conditions requiring special consideration. Mutuality of interest will bring about a solution in nearly every case. It is only during a period of general retrenchment that these conditions are not likely to obtain.

Suggested Developments.—In line with the development of the joint use of poles it is apparent that the possibility exists for further co-operative effort. The time is not far distant when over half of all poles will be occupied jointly. With the present day tendency toward concentration it would be a desirable undertaking for the pole using utilities to have their entire pole record centralized. This possibility was given consideration when the unit system was adopted and pole report forms are in use for joint poles which, if adopted universally, would bring about the result proposed without any abnormal demands upon the operating companies. If it is desirable at all times to have a correct valuation of the pole plant, such a method offers an easy solution.

PROCEDURE FOR HIGHWAY LIGHTING DISTRICTS

BY E. B. WALTHALL

(The ever increasing usefulness of the beautiful highways of the West is daily bringing about a civic pride in the manner of illumination. Hitherto in unincorporated towns and villages no legal procedure has been available whereby lighting districts may be formed to properly provide and operate a district under such conditions. Here is an article by the assistant general manager of the San Joaquin Light & Power Corporation at Fresno, which gives every detail necessary for such procedure in California. The paper is to be presented before the convention of the Pacific Coast Section of N. E. L. A. at Riverside as a part of the report of the Commercial Committee —The Editor.)

Highway Lighting Districts are formed under Act 1466, approved March 20, 1909. Stats, 1909, p. 551. Amended 1911, p. 439; 1913, p. 447; 1915, p. 943. This Act, including all of the amendments thereto, reads as follows:

(Exhibit A)

Act 1466

An Act to allow unincorporated towns and villages to establish, equip and maintain systems of street lights on public highways; to provide for the formation, government and operation of highway lighting districts; the calling and holding of elections in such districts; the assessment, collection, custody and disbursement of taxes therein; and the creation of ex-officio boards of supervisors.

"Approved March 20, 1909. Ctats. 1909, p. 551.) Amended 1911, p. 439; 1913, p. 447; 1915, p. 943.

1. The words and phrases used in this act, shall, for the purposes of this act, unless the same be contrary to or inconsistent with the context, be construed as follows:

(1) "Public highways," shall include any highway, county road, state road, public street, avenue, alley, park, parkway, driveway, or public place, in any county, or unincorporated town or village dedicated to the public and generally used for traffic by the public.

(2) "Street lights," or "street illumination," shall include any system of illumination by means of street lights using gas, electricity, or other means of illuminant deemed feasible; such lights to be set upon poles, or suspended in the air.

2. Any unincorporated town or village of this state may establish a highway lighting district for the purpose of installing and maintaining a system of street lights on public highways, for the better protection of its residents, in accordance with the provisions of this act.

3. Upon the application, by petition, of twenty-five or more taxpayers and residents of said town or village presented at a regular meeting of the board of supervisors of the county in which the said town or village is situated, praying for the formation of a public highway lighting district, and setting forth the name and boundaries of the said proposed district, the board of supervisors shall fix a day and hour for hearing the same, and protests of interested parties, not less than twenty-five nor more thirty days after the date of presentation thereof. The clerk of the board shall thereupon cause notices of the filing and hearing of such petition to be posted in three of the most public places in said district. Said notice shall be headed "Notice of the proposed formation of ..... Lighting District" (stating name of the proposed lighting district), in letters not less than one inch in length, and shall, in legible characters, state the fact and date of the filing of such petition, the date and hour set for hearing such petition and protests of interested parties, specify the boundaries of the proposed district and refer to said petition for further particulars. The said clerk shall also cause a notice, similar in substance, to be published at least once a week for two consecutive weeks in a newspaper of general circulation printed and published in the county in which the proposed district is located and designated by said board for that purpose. Said notice must be posted and published, as above provided, at least seven days before the date set for the hearing of said petition. Any person interested, objecting to the formation of said district, or to the extent of said district, or to the proposed amendment, or to the inclusion of his property in said district, may file a written protest, setting forth such objections, with the clerk of said board at or before the time set for the hearing of said petition. The clerk of said board shall endorse on each such protest the date of its reception by him, and, at the time appointed for the hearing above provided for, shall present to said board all protests so filed with him. Said board shall hear said petition and protests at the time appointed, or at any time to which the hearing thereof may be adjourned, and pass upon the same, and its decision thereon shall be final and conclusive. If any of such protest be against the extent of said district, or against the inclusion of property in said district, then the board shall have power to make such changes in the boundaries of the proposed district as it shall find to be proper and advisable, and shall define and establish such boundaries, but said board shall not extend the boundaries of said district, nor shall said board modify such boundaries so as to exclude from such proposed district any territory which will be benefited by said improvement, nor shall any territory which will not, in the judgment of said board, be benefited by said improvement be included within such proposed district. At the expiration of the time within which protests may be filed, if none be filed, or if protests be filed, and, after hearing be denied or the boundaries of the proposed district be defined and established with modifications, as above provided, then said board shall be deemed to have acquired jurisdiction to further proceed in accordance with the provisions of this act.

The said board of supervisors must, within thirty days after acquiring jurisdiction to proceed as provided above, by resolution, order that an election be held in the said proposed district for the determination of the question, and shall appoint three qualified electors thereof to conduct said election; which must be held within forty days from the date of the order.

(Amendment approved May 29, 1915. Stats. 1915, p. 944.)

Election to Determine Proposition

4. Said election shall be called by posting notice thereof in three of the most public places in said proposed lighting district, and by publication in a daily or weekly paper therein, if there be one, at least once a week for not less than fifteen days. Said notices must specify the time, place and purposes of said election, give the boundaries of the said proposed lighting district; and the hours during which the polls will be kept open; provided that in districts with a population of ten thousand or over, the polls must be opened at 8 o'clock a. m., and kept open until 7 o'clock p. m., and in districts where the population is less than ten thousand, the polls must not be opened before 1 o'clock p. m., and must be kept open not less than six hours.

Conduct of Election

5. Said election shall be conducted in accordance with the general election laws of this state, where applicable, without reference to form of ballot or manner of voting, except that the ballots shall contain the words, "For Lighting District," and the voter shall write or print after said words on his ballot, the word "Yes" or the word "No."

Who Entitled to Vote

6. Every qualified elector, resident within the proposed district for the period requisite to enable him to vote at a

general election, shall be entitled to vote at the election above provided for.

7. It shall be the duty of the election officers to publicly canvass the votes immediately after the close of the election, and to report the result of said election to the board of supervisors, within five days subsequent to the holding thereof.

Duties of Supervisors.

8. If a majority of the votes cast at said election shall be in favor of a lighting district, the said board of supervisors may, by resolution, establish said lighting district.

9. If a majority of the votes cast shall be against the lighting district, the board of supervisors, shall by order, so declare; no other proceedings shall be taken in relation thereto until the expiration of one year from the date of presentation of the petition.

Evidence of Validity

10. The fact of the presentation of the petition, and the order establishing the lighting district, shall be entered in the minutes of the board of supervisors and shall be conclusive evidence of the due presentation of a proper petition, and that each of the petitioners was, at the time of signature and presentation of the petition, a taxpayer and resident of the proposed district, and of the fact and regularity of all prior proceedings of every kind and nature provided for by this act, and of the existence and validity of the district.

Supervisors to Act for Lighting Districts

11. The board of supervisors of the county wherein lighting districts have been established under the provisions of this act, shall be and they are hereby designated as and empowered to act as ex officio, the board of supervisors of each and all of such lighting districts which may hereafter be established within such county under the provisions of this act; serving without compensation; and said boards of supervisors shall be authorized and they are hereby empowered, and it shall be their duty:

Powers and Duties

First—To make all rules, regulations and laws necessary for the administration, operation and maintenance of the lighting districts situated within their county.

Second—To supervise, and plan a system of street illumination for any and all lighting districts within their county, and to determine and decide upon the kind and manner of illuminant most feasible for the district; but nothing herein shall prevent the board of supervisors from installing and maintaining electric lights on highways in such districts, and to pay for the same out of the general road fund of the county or district road fund.

Third—To indicate the placing and installation of the lights and any and all subsequent additional lights.

Fourth—To receive bids, award and make contracts with lighting companies to the very best advantage of the district, for the installation and maintenance of poles, wires, lights and other accessories; and for the supplying of electric current, gas, or such other illuminant as may be determined upon; and for any and all other things that may be necessary to carry out the full meaning and provisions of this act.

Fifth—To determine the number of employees, if any, necessary to properly care and maintain the lights; to prescribe their duties and fix their compensation, which said employees shall hold their positions at the pleasure of the board.

Sixth—Upon the application, by petition, of twenty-five or more taxpayers and residents of such lighting district, asking for the installation and maintenance of additional lights, which said petition must be filed on or before the first day of September in any year; to immediately estimate the cost of installing and maintaining such additional lights, and to include in the tax levy for the ensuing fiscal year a tax upon the taxable property within such lighting district, at the equalized value thereof for that year, sufficient to pay the cost of installing and maintaining such additional lights; after which to proceed with the installation of such additional lights.

Seventh—To designate the hours for lighting such districts.

Eighth—To perform any and all other acts and things necessary or proper to carry out the provisions of this act.

Ninth—To, within ten days after the establishment of such district, proceed with carrying out the provisions of this act by advertising for bids for installing, caring for and maintaining the lights determined upon; and for supplying the district with all the gas, electricity or such other illuminant as has been determined upon, necessary for operating and maintaining any and all of the lights which have been already installed or which are to be installed within such district. The contract to be awarded to the lowest responsible bidder; provided, however, that the rates to be paid therefore must not exceed in any event the rates paid at that time by said county for highway lighting in other portions of said county. The rates to be paid must not be fixed for a term exceeding five years, and the board of supervisors must reserve the right to abrogate such contract whenever gas or electric current is offered to be supplied at two-thirds of such fixed contract price.

Prior Light, Maintenance

12. If prior to the formation of a lighting district any lights have been maintained, by public subscription or paid for out of the district road funds, within any territory which subsequently forms itself into a lighting district under the provisions of this act; at the time of the establishment of such lighting district, or else at the time of expiration of any then existing contract for the maintenance of such lights; such lights and the future cost of maintaining and operating them shall be included in the estimate of the board of supervisors and shall thenceforth be maintained as a part of the lighting system of such lighting district.

Authority to Erect Poles

13. In granting authority to lay down pipes or to erect poles and string wires, and in contracting for gas or electric current, the board of supervisors must impose such restrictions and conditions, and provide for such locations of the various wires and lights, so as to work the least possible public or private inconvenience.

Estimate for Tax Levy

14. On or before the first day of September in each and every year the board of supervisors of any county wherein a lighting district has been established, shall make an estimate of the cost of conducting and maintaining such lighting district for the ensuing fiscal year, together with the cost of installing and maintaining such additional lights as may have already been petitioned for by the residents of such lighting districts, and for the cost of any other things which may be necessary for carrying out the purposes of this act.

Lighting District Tax Levy

15. When such estimate shall have been made, the board of supervisors of any county wherein a lighting district has been established, must, at the time of levying county taxes, levy a special tax upon all of the taxable property within the limits of such lighting district at the equalized value thereof, sufficient in amount to maintain the said lighting system, and to install any additional lights, or for any or all of the purposes of this act. When a lighting district is organized subsequent to the time of levying county taxes in any year, the board of supervisors may authorize the immediate installation of said lighting system in such district and shall include in the levy of taxes for said lighting district for the ensuing fiscal year, a sum sufficient to pay the cost of the installation and maintenance of said lighting system in said district for that portion of the preceding fiscal years

for which no levy of taxes was made in such year, for said purpose.

Disposition of Revenue

16. The revenue derived from said tax, together with all other moneys acquired in whatsoever manner by the lighting district, shall be paid into the county treasury to the credit of the lighting fund of the district wherein said tax was collected, subject only to the order of the board of supervisors of said district, and to be by them expended only for and on behalf of the district wherein such money was collected.

Designation of Districts

17. Every lighting district formed or established under the provisions of this act, must be designated by the name and under the style of ..... lighting district, (using the name of the district), of ..... county, (using the name of the county in which such district is situated), and in that name the board of supervisors may make and award contracts, and may sue and be sued.

Dissolution, Petition, Election, Disposition of Property, Outstanding Indebtedness

18. The district may at any time be dissolved upon the vote of two-thirds of the qualified electors thereof, at an election called by the board of supervisors upon the question of dissolution. Upon a petition signed by fifty or more property owners and residents of such lighting district, asking for the dissolution of said district, the board of supervisors shall within thirty days after receiving said petition, by resolution, order that an election be held in the said district, for the determination of the question, and appoint three qualified electors thereof to conduct said election. Such election shall be called and conducted in the same manner as other elections of the district. Upon such dissolution, any property which may have been acquired by such lighting district shall vest in any incorporated town or city where said lighting district shall be wholly within, or be identical with the corporate limits of such incorporated town or city; and the property in the territory of said district outside of the limits of such incorporated town or city shall vest in the county board of supervisors; and if there be no such incorporated town or city, then such property shall vest in the board of supervisors of the county wherein such lighting district is situated until the formation of such incorporated town or city; provided, however, that if at the time of the election to dissolve such district there be any outstanding indebtedness of such district, then, in such event, the vote to dissolve such district shall dissolve the same for all purposes excepting only the levy and collection of taxes for the payment of such outstanding indebtedness of such district; and from the time such district is thus dissolved until such indebtedness is fully paid, satisfied and discharged, the legislative authority of such incorporated town or city, or the board of supervisors, if there be no such incorporated town or city, is hereby constituted ex officio the board of supervisors of such district. And it is hereby made obligatory upon such board to levy such taxes and perform such other acts as may be necessary in order to raise money for the payment of such indebtedness, as herein provided.

The formation of lighting districts as outlined in the above Act can be made by the central station cooperating with the county district attorney's office. It may be advisable in some instances for the central station to prepare for the district attorney's office all of the papers in connection with the formation of these districts, or it may be advisable to prepare only a portion thereof. Some of the central stations are preparing all of the papers, and the outline herein contained will be upon the assumption that the district attorney's office will not prepare any of the papers.

As stated in the Act, the first action necessary is that the taxpayers and residents of the non-incorporated territory desiring the establishment of a highway lighting district prepare a petition praying the board of supervisors of the county to establish such lighting district. This petition may be in the usual form of petitions. This petition must definitely designate the boundaries of the district to be established. It may be necessary in some instances for an engineer to make a survey of the district in order to definitely fix the boundaries. This surveying may be done by the central station's surveyor. The petition must be signed by not less than twenty-five taxpayers who are residents of the lighting district to be established.

Upon the receipt of this petition from the signers thereof, usually transmitted to the board of supervisors of the county by the central station, the board of supervisors shall issue an order for the hearing of said application, and all protests, if any, of the interested parties not less than twenty-five nor more than thirty days after the presentation of such petition. The order of the board of supervisors is in the following form:

Exhibit "B"

Before the Board of Supervisors of the County of Fresno, State of California

In the Matter of the Formation
of
A Public Highway Lighting District,
To Be Known as ..... Lighting
District of ..... County.

A petition for the formation of a Public Highway Lighting District, to be known as "..... Lighting District of ..... County," duly signed by more than twenty-five taxpayers and residents of the town or village of..... in the County of ..... State of California, by which petition application is made by said taxpayers and residents for the formation of a Public Highway Lighting District, to be known as "..... Highway Lighting District of ..... County," with boundaries described in said petition having been filed and presented to the board of supervisors of the County of ....., State of California, at a regular meeting thereof held on the ..... day of ....., 19.., and the board of supervisors having determined that said petition is in due form and is properly made and signed by more than twenty-five of the taxpayers and residents of said town or village of ....., within the exterior boundaries of said proposed Public Highway Lighting District.

It Is Hereby Ordered that the ..... day of ..... 19... at the hour of ..... o'clock .... m., of said day at the rooms of said board of supervisors in the County Court House in the City of ....., County of ....., State of California, be, and the same is hereby fixed, as the day, hour and place for the hearing of said application, and protests of interested parties.

And It Is Further Ordered that the clerk of this board cause notices of the filing and hearing of said petition to be posted in three of the most public places within said proposed district, and to be published at least once a week for two (2) successive weeks in the ....., a newspaper of general circulation, printed and published in said County of ....., and within the proposed Public Highway Lighting District, which is hereby designated by said board of supervisors for that purpose, and which said notice shall be posted and published as above provided at least seven (7) days before said date set for hearing of said petition. Said

notice to be so posted shall have the heading thereof printed in letters not less than one inch in length and said notice to be posted and published shall be in the words and figures following, to wit:

BOARD OF SUPERVISORS,

By.....

Clerk of the Board of Supervisors.

The clerk of the board of supervisors shall thereupon cause notices of the filing and hearing of such petition to be posted in three of the most public places in such district, and shall also cause a notice similar in substance to be published at least once a week, for two consecutive weeks, in a newspaper of general circulation, printed and published in the county in which the proposed district is located and designated by the board for that purpose. Such notice must be posted and published, as above provided, at least seven days before the date set for the hearing of said petition. The form of the notice to be inserted in the newspaper and posted at three public places is of the following form:

Exhibit "C"

Notice of the Proposed Formation of..... Highway Lighting District of ..... County

Notice Is Hereby Given that a petition and application for the formation of a Public Highway Lighting District, to be known as "..... Highway Lighting District of ..... County," duly signed by more than twenty-five taxpayers and residents of the town or village of ....., in the County of ....., State of California, and within the exterior boundaries of said proposed Public Highway Lighting District, was presented to and filed with the board of supervisors of the County of ....., State of California, at a regular meeting of said board of supervisors on the ..... day of ....., 191.., and that the said board of supervisors fixed the ..... day of ....., 19...., at the hour of ..... o'clock ....m, of said day at the rooms of said board of supervisors, in the County Court House, in the City of ....., County of ....., State of California, as the time and place for the hearing of said petition, and the protests of interested parties.

The lands and premises included within said proposed Public Highway Lighting District are situated in the County of ....., State of California, and bounded and particularly described as follows, to wit:

(Here accurately describe the district boundaries as contained in the petition.)

All persons interested are notified to appear before the board of supervisors, of the County of ....., State of California, at the rooms of said board of supervisors, in the County Court House, in the City of....., County of ....., State of California, on the .... day of....., 19...., at the hour of ..... o'clock ....m. of said day, then and there to show cause, if any they have, why said petition should not be granted and said Lighting District created and formed as therein prayed for.

By order of the Board of Supervisors this ..... day of ....., 19.....

BOARD OF SUPERVISORS,

By.....

Clerk of the Board of Supervisors.

The party or parties designated by the clerk of the board of supervisors to actually post and publish the notice shall make a written affidavit that such notices have been posted and published. Form of affidavit is as follows:

Exhibit "D"

Affidavit of Posting of "Notice of the Proposed Formation of Lighting District of ..... County"

State of California—ss.
County of .....
....., being first duly sworn, upon oath deposes and says: That he is a citizen of the County of ....., State of California, over the age of eighteen years; that on the ..... day of ....., 19...., he posted "Notice of the Proposed Formation of ..... Lighting District of ..... County," a copy of which is hereto attached and made a part and portion of this affidavit, in three of the most public places within the boundaries of said proposed Lighting District, to wit:
One at .....,
one at .....,
and one at .....,
that each of said notices so posted was headed "Notice of the Proposed Formation of ..... Lighting District of ..... County" in letters not less than 1 in. in length.
.....

If upon or before the day set forth in the posted and printed notices no protests are made to the board of supervisors, either in writing or in person, then the board of supervisors shall be deemed to have acquired jurisdiction to further proceed in accordance with the provisions of this Act, and must, within thirty days after acquiring such jurisdiction, order that an election be held in the proposed lighting district for the determination of the question, and shall appoint three qualified electors thereof to conduct said election.

The board of supervisors shall pass an order granting the petition and calling the election. The form of that order is as follows:

Exhibit "E"

Before the Board of Supervisors of the County of ....., State of California

In the Matter of the Formation
of
..... Lighting District
of ..... County.

Order Granting Petition and Calling Election.

The petition and application of more than twenty-five duly qualified taxpayers and residents of the town or village of ....., and of the district hereinafter described, in the County of ....., State of California, by which application is made by said taxpayers and residents for the formation of a public highway lighting district, to be known as ..... Lighting District of ..... County, with the boundaries in said petition and hereinafter described, coming on regularly to be heard before the board of supervisors of said County of ..... on ....., the ..... day of ....., 19...., at the hour of .... o'clock, ...m., and the said petition and application now at the said date and hour last named coming on to be heard, and it appearing to said board of supervisors that due notice of the hearing of said petition and application has been given by the clerk of this board as required by law and the order of this board heretofore made in that regard, and it further appearing to this board that no protests against or objections to the granting of said petition and application have been made or filed, and the said board of supervisors now hearing evidence offered in support of said petition, and being fully advised in the premises, it is, therefore, ordered by said board of supervisors that the said application and petiiton be granted, and that said ..... Lighting District of ..... County be established, if the electors residing within the boundaries thereof shall so decide at an election to be held for that purpose, and that said ..... Lighting District

of ..... County shall have the boundaries mentioned in said petition and application, which said boundaries are hereby defined and established as follows:

(Here copy the description of the district to be formed as contained in the petition.)

It is further ordered that an election be held in the said proposed district, for the determination of the question as to whether or not said ..... Lighting District of ..... County shall be established with the boundaries above described, which election shall be held at ....., in the village or town of ..... County of ....., State of California, on ....., the ..... day of ....., 19.... and..... and ....., three qualified electors of said proposed district are hereby appointed judges to conduct said election.

It is further ordered that the clerk of this board be, and he is hereby directed to give notice of said election, and to call the same by posting notice thereof in three of the most public places in said proposed lighting district, and by publication of the same in the ..... a newspaper printed and published in the village or town of ....., at least once a week for not less than fifteen days before said election.

It is further ordered that said notice specify the time, place and purpose of said election, and give the boundaries of the said proposed Lighting District as herein defined and established, and the hours during which the polls shall be kept open, namely, from 1 o'clock p. m. of said date to 7 o'clock p. m. of said date.

Said election shall be conducted in accordance with the general election laws of this state, as far as applicable, without reference to form of ballot or manner of voting, except that the ballot shall contain the words "For Lighting District," and the voter shall write or print after said words on his ballot the word "Yes" or the word "No."

Every qualified elector, resident within the proposed district for the period requisite to enable him to vote at a general election, shall be entitled to vote at the election above provided for.

It shall be the duty of the election officers above named to publicly canvass the votes immediately after the close of the said election, and to report the result of said election to this board of supervisors within five days subsequent to the holding of said election.

Adopted by the Board of Supervisors of the County of ..... at a regular meeting of said board held on the ..... day of ....., 19...., and by the following vote:

Ayes: Supervisors .....

.....

Noes: .....

Absent: .....

Attest.....

Clerk.

Notice shall be given the electors that such election will be held, by posting in three of the most public places of said proposed district, and by publication in a daily or a weekly paper therein, if there be one, at least once a week for not less than fifteen days. The form of the notice to be printed and posted shall be as follows:

Exhibit "F"

Election Notice

Pursuant to an order of the board of supervisors, duly made and entered in its minutes on the ..... day of ....., 19....

Notice Is Hereby Given that an election will be held at ....., in the village or town of..... in the County of ....., State of California, on ....., the ..... day of ....., 19.... Said election will be held to determine the question of the formation of a public highway lighting district, to be known as ..... Lighting District of ..... County, with boundaries proposed as follows, to wit:

(Here copy the description of the district to be formed as contained in the petition.)

Said election shall be conducted in accordance with the general election laws of this state as far as is applicable, and the polls shall remain open from the hour of 1 o'clock p. m. until the hour of 7 o'clock p. m. of said ..... day of ....., 19....

For the purpose of conducting said election the board of supervisors has appointed ...., three qualified electors of said proposed district, as officers to conduct said election. It shall be the duty of said election officers above named to publicly canvass the votes immediately after the close of said election, and to report the result of said election to this board of supervisors within five days subsequent to the holding of said election.

Dated this ..... day of ....., 19.....

.....

Couny Clerk and ex officio Clerk of the Board of Supervisors of ..... County, California.

By.....

Deputy Clerk.

The party or parties designated by the clerk of the board of supervisors to print and post the election notices shall make affidavit to the board of supervisors that such notices have been posted and printed. The form of the affidavit is as follows:

Exhibit "G"

Affidavit of Posting of Notice of Election

State of California.—ss.
County of .....

..... being first duly sworn, upon oath deposes and says: That he is a citizen of the County of ....., State of California, over the age of eighteen years; that on the ..... day of ....., 19...., he posted Notices of Election, a copy of which is hereto attached and made a part and portion of this affidavit, in three of the most public places within the boundaries of said proposed ..... Lighting District of ..... County, as follows, to wit:

One at the .....; one at..... and one at .....

.....

.....

Subscribed and sworn to before me this ..... day of ....., 19....

.....

Notary Public in and for the County of ....., State of California.

The election having been held, the board of supervisors shall be advised as to the outcome of same. If a majority of the votes cast shall be in favor of the district, the board of supervisors may by resolution, establish such lighting district and at that time adopt rules, regulations and laws necessary for the administration, operation and maintenance of said lighting district, which rules and regulations shall include the kind of illuminant, type of lamp, etc., and as to whether or not the district shall make the installation of the necessary equipment or contract with the central station for the installation of the necessary equipment, together with a contract for the operation of the equipment. The central station usually agrees with the board of supervisors in advance of the adoption of resolutions, as to the type of service and the rates to be charged, and it is the

custom of the board of supervisors to embody in their resolution, rules and regulations that conform to the understanding previously had between the board of supervisors and the central station.

Exhibit "H"

Before the Board of Supervisors of the County of ....., State of California

In the Matter of the Formation of the ..... Highway Lighting District of ..... County.

Resolution Establishing said Lighting District, Determining the Kind of Illuminant to be Used, and Establishing Rules and Laws Necessary for the Administration, Operation and Maintenance of said Distrct.

Whereas, heretofore, to wit.....on the.....day of.....19...., there was duly filed and presented to the board of supervisors of the County of ....., State of California, at a regular meeting thereof, a petition for the formation of a public highway lighting district, to be known as "..... Highway Lighting District of ..... County," which was duly signed by more than twenty-five taxpayers and residents of the town or village of ....., in the County of ....., State of California, and by which petition application was made by said taxpayers and residents for the formation of a public highway lighting district, to be known as "..... Highway Lighting District of..... County," with boundaries described in said petition and hereinafter described; and

Whereas, on the ..... day of ....., 19...., the said petition and application came regularly on for hearing before this board, and it then appearing that due notice of the filing and hearing of said petition had been posted, published and given as required by law and the order of this board, and no protests having been filed or made to the granting of said petition or to the establishment of said public highway lighting district, and no one objecting thereto, the said board of supervisors did thereafter, to wit, on the ..... day of ....., 19...., by resolution order that an election be held in the said proposed district on the ..... day of ....., 19...., for the determination of the question as to whether or not said public highway lighting district should be established, and did appoint three qualified electors thereof to conduct said election; and

Whereas, After due and lawful notice of said election by posting and publication as required by law and the order of this board, said election was duly held in the said proposed district on the said ..... day of ....., 19...., at which election there was submitted to the qualified electors of said proposed district the question of the establishment of said public highway lighting district; and

Whereas, There has been duly returned to this board the report of the election officers duly appointed and qualified to conduct said election and who conducted the same, from which it appears, and this board now finding, that said election was regularly and duly held in said proposed lighting district on the ..... day of ....., 19...., in accordance with the resolutions and orders of this board of supervisors and the notices posted and published therefor; that the polls at said election remained open continuously for not less than six hours, to wit, between the hours of one o'clock p. m. and seven o'clock p. m. on said day; that there were ..... votes cast at said election; that "For Lighting District—Yes" received ..... votes, and "For Lighting District—No" received ..... votes.

Now, Therefore, It duly appearing and this board finding that the proceedings heretofore had and held in the matter of the establishment of said public highway lighting district having been regularly and duly had and held, and that a majority of the votes cast at said election were in favor of said lighting district.

Be It Resolved, By the board of supervisors of the County ....., State of California, that said public highway lighting district be, and the same is hereby established, and that the same shall be known as "..... Highway Lighting District of ..... County."

And Be It Further Resolved, That said ..... Highway Lighting District of Fresno County is established with the following boundaries, being the same boundaries as those described in said petition and in the notices heretofore posted and published in this proceeding, to wit:

The lands and premises included within said lighting district are situate in the County of ....., State of California, and bounded and particularly described as follows, to wit:

(Here copy the description of the district to be formed as contained in the petition.)

And Be It Further Resolved, That the following rules, regulations and laws necessary for the administration, operation and maintenance of the said lighting district be and the same are hereby made and adopted:

(Insert here whatever rules and regulations might be adopted by the board.)

Ayes: Supervisors .....

.....

Noes: .....

Absent: .....

Attest: .....

Clerk.

Within ten days after the final establishment of the district and the adoption of rules and regulations governing the type of service, etc., the board of supervisors shall advertise for bids for installing, caring for and maintaining the lights determined upon, and for supplying the district with illuminant, as has been determined upon, necessary for operating and maintaining any and all of the lights which are to be installed within such district. Contracts to be awarded to the lowest responsible bidder, provided, however, that the rates to be paid therefor must not exceed in any event the rates paid at any time by said county for highway lighting in other portions of the county. The rates to be paid must not be fixed for a term exceeding five years, and the board of supervisors must reserve the right to abrogate such contract whenever illuminant is offered to be supplied at two-thirds of such fixed contract price.

The increased immunity from fire hazards experienced in transmission lines crossing the national forests is gratifying to all interested in the electrical industry. The number of fires suppressed on National Forest lands during the calendar year 1915 was 6324, as against 7018 in 1914, and an average annual number of 4759 during the past five years says Henry S. Graves, Chief of the Forest Service, in his annual report just published. While more than the average number of fires occurred the timbered area burned over was but 155,416 acres, or 30 per cent less than the average per year for the period 1911-1915 inclusive. The average loss per fire was $60.41. Forty-four per cent of the fires were confined to areas of less than one-quarter of an acre.

MERCHANDISING ELECTRICAL ENERGY

(The merchandising of electrical energy and energy consuming devices involves not only the highest skill in commercial practice, but especially does it require utmost efficiency in organization. Here are articles by well-known authorities on this subject that should commend themselves to every sales force in central stations throughout the West. The papers have been prepared as a part of the report of the Commercial Committee for consideration at the Pacific Coast Convention of N. E. L. A. at Riverside.—The Editor.)

COMMERCIAL ORGANIZATION

BY E. B. CRIDDLE

General Agent, Southern Sierras Power Company

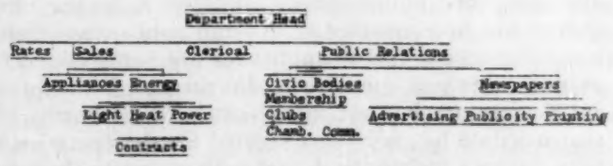
An efficient commercial department for an electrical corporation must be adapted to the size and operating conditions of the corporation; it may sometimes consist of one man, or there may be a large force. Some of the employes may be connected solely with the commercial department, while others may be in charge of the entire business of a given territory, reporting to and receiving orders from the heads of all departments.

The object of a commercial department and its business is to establish and maintain cordial relations of mutual respect and confidence with the public and by reasonable and fair dealing, and through this relationship, coupled with good salesmanship, to sell its output to the public; to supply to the public, energy for light, heat and power, displacing all other kinds of either form of energy.

In the accomplishment of this result, the scope of the department should embrace all branches of public relations and salesmanship, whether handled by one man for a small company, or under the general direction of a department head for a large company, with a number of sub-heads, each in charge of several skilled workmen.

The department head, with different western companies, holds usually one of the following titles: President, vice-president, general manager, general agent, manager of commercial department, commercial agent or superintendent. He must be a man of poise, fair-minded,level headed, diplomatic, courteous, industrious, loyal to the company, honest, truthful, a good judge of character; must understand thoroughly this company's rates, its policies, rules, regulations, practices, and be able to present clearly and effectively any proposition he may have in hand. He must also be capable of training his assistants to follow his example.

The organization has as many individual subheads as may be necessary, embracing the following branches of service:



In a small organization, the department head may be all things to all men; in a larger organization, the local representative in each territory may look after all the above branches of work, and in addition, look after operating, construction, collections and billing, reporting to the department head; or he may have a local organization similar to the above general organization, the detailed reports being made by the local men to the district manager, agent or superintendent, and by him transmitted in such detail as may be required, to the department head.

In a large organization, both at headquarters and in the various territories, the function mentioned will be performed by as many men as circumstances require. For instance, the head may be the general agent. He may be the rate expert, or may have a rate expert with various statisticians and assistants. In charge of sales, may be a sales manager or new business manager, who, if the organization is large enough, will have an appliance sales manager, under whose direction will work appliance salesmen, range salesmen and motor salesmen. Also, under the sales manager may be power salesmen and lighting or cooking or heating salesmen, each of whom will secure contracts for various kinds of service, to be signed, possibly by the salesman securing the same, then by the sales manager, the general agent and the president or vice-president, depending upon the practice of the company. In some companies, the sales manager and appliance manager report independently to the general agent or department head.

The clerical force—under a chief clerk, if the force is large—will consist of stenographers for letter writing, reports and contracts, filing clerk, statistical clerk, recording contracts and results per customer, per horsepower, per acre or per unit of product.

The department head, such of his assistants as may seem wise and the district managers, agents or superintendents should be members of the N. E. L. A., of the local chamber of commerce and certain clubs where business men may be met. The newspaper work may be handled by the department head, or he may delegate it to one or more. For instance, there may be an advertising expert, to prepare all advertisements; either the same man or another, who is a good writer, to prepare news articles, which the newspapers will welcome, of a nature to cultivate favorable public opinion to the company and its business. Local printing should be given to local papers, so far as practicable.

Having secured an efficient force, as many young men as may be found desirable should be in training to fill all these positions, working for several years as students or understudies. Such an organization, composed of efficient, loyal, industrious men, will make many friends for the company and secure much new business.

MERCHANDISING

BY A. W. CHILDS

Superintendent of Sales, Southern California Edison Company

It is not the intention in this paper to cover the general subject of merchandising of current consuming devices. That subject was so thoroughly and completely discussed in the report of the Committee on Merchandising presented at the San Francisco convention of the National Electric Light Association that no one has since attempted to add to or take from it. Our purpose will be to discuss the problem from the standpoint of the central station and the dealer, and to show first why the central station commenced merchadising; secondly why the central station is obliged to continue merchandising to a certain extent, and in the third place the co-operative opportunity of the dealer.

It makes a difference whether we look at the matter from the standpoint of merchandising only, or whether we also consider the question of load building. It was the necessity for a load that induced the central station to take the matter in hand in the first place, and it is from this viewpoint that they must, from time to time, consider the situation, otherwise the whole problem would be left with the department store and dealer.

Twelve or more years ago, when one of our Southern California central stations had a vision of load building possibilities through the use of lamp socket appliances, there was no knowledge on the part of the consumers concerning such devices and, consequently, no market for them. It was of considerable consequence to the company concerned whether the load was secured within a reasonable length of time or through a long drawn out process. If the central station handled the selling, it could utilize its buying power, absorbing the expense which always attends the successful introduction of new things and by placing a large initial order and by sending salesmen direct to its consumers, take the shortest and most direct route in getting the appliances in use.

The electric laundry iron was just coming out and was practically the only lamp socket heating appliance then known, so, with hope that the result would justify the venture, the responsibility was assumed and an order placed. We will not dwell upon the difficulties encountered in persuading the consumers to use the irons. Many were skeptical, looking upon them as a thing devised and foisted upon them for the purpose of unwarrantably increasing their bills for energy but, with persistent effort, the irons were left on trial with those who could be induced to accept them, and this broad, liberal policy was the beginning of a movement which has given that company a connected load in electric appliances alone of approximately 90,000 kilowatts without adding to the capital investment; and producing an annual revenue, on the basis of $3.60 per appliance per year, of $630,000.

During these early years, the manufacturers looked to the central station to market their products and gradually, as the central station placed the appliances in service, satisfied users carried the good news to their neighbors, many of whom endeavored to buy from the regular retail stores where they were accustomed to shop. Central station salesmen making systematic visits from house to house, hastened the conversion and, as inquiries began to come in, the interest of dealers and hardware and department stores, was engendered. As the installations increased, store sales also increased, and during the years that have elapsed the business of the dealer has consistently grown and enlarged due, to quite an extent, to the education of the public by the vigorous, persistent and continuous efforts of the central station.

The work of the central station has been and is to find new uses for appliances and to co-operate with the dealers in supplying the demand already created. The one is dependent upon the other. It is just as important in this age of electric progress that new uses be found as it is that attention be given to sales already stimulated and it is in this that the central station fulfills its mission to manufacturer, jobber and dealer in creating the demand as well as assisting in satisfying it and, by this means, making the appliance portion of its business self-supporting. On the other hand, the dealer has his function to perform in marketing appliances. When the consumer has been approached by a salesman of the central station, the germ of desire has been kindled and, the goods being seen on display in the windows of stores, the advantages portrayed by the salesman, are brought to mind and the dealer enabled to make the sale.

Had the central station, twelve years ago, laid down a plan for the dealers to follow in order to build up the enormous demand for electrical appliances which exists today, and told them to work the plan alone, they would not have done nearly as much business as they have been enabled to do through the co-operation of the company, nor would the company have secured its own large volume of sales and consequent load. Instead, the company said "Come on" and lead the way and, with at first an occasional glimpse of merchandising profits, becoming more constant as the years pass, the business has steadily enlarged until, last year the dealers of Southern California, instead of running second, outsold the central station.

Many central stations do not sell appliances consuming less than 500 watts and retailing at $4.50 to $7.50, such as toasters, irons, percolators and electric grills. This has left a clear field to the dealer for appliances selling at higher figures and consuming less current, such as sewing machine motors, vacuum cleaners and washing machines, the sale of which carries a substantial profit in each case. One Los Angeles dealer recently sold 160 vacuum cleaners in one month.

From the central station's standpoint, the uses of electricity are multitudinous and the only way the energy can be consumed is through appliances of one sort or another. These appliances are being added to as new uses are conceived. Furthermore, the present devices are not yet introduced into all homes, so that it would be very short sighted for the central station, anxious for the load, and with a perishable commodity going to waste, to wait for the dealer to build up the business to a point of saturation. Nor would it be fair to the consumer, because the central station lowers its rate as fast as consistent and as the load

factor increases. This is brought about by the greater use of appliances and all consumers benefit from the condition. For instance, one California company, having 1300 electric ranges in use, has announced that, when 2000 ranges are in service, a reduction of ½ cent per kw.-hr will be made for cooking service. It would be very poor business for all concerned to hold up this load and the consequent benefits to the consumer waiting for a sufficient number of customers to drop into the stores of the dealers and purchase enough electric ranges to bring the condition about. The central station cannot afford to sit and wait.

We are passing through the same process of evolution in introducing the electric range that obtained during the introduction of lamp socket appliances, with this advantage, that the popularity of the small devices has paved the way for the range. It is necessary, however, with the range as with the iron, to absorb a large expense for promotion work and for this reason it is essential during this promotion period that the central station sells the ranges itself.

There is some difference of opinion as to who should do the installing. It is important that the installation expense be kept to a minimum in order to get a large number of stoves in service, as this expense is high enough under the most favorable circumstances. We believe that, for the present, the central station should make the installations. As the business develops, it can be gradually worked around so that the installation work can be done by the contractors upon a profitable basis, but that time has not yet arrived. When the central station sells and installs the ranges, results are obtained more easily and quickly and the number of ranges thus spread around helps to promote the game. Dealers have not at stake the amount the central station has and their interest does not justify them in absorbing the promotion loss that the central station can afford to sustain. The greatest obstacle in electric range promotion is the first cost. This is obviated to a considerable extent where the central station sells and installs at a minimum margin of profit, on the installment plan.

The same thing is true of the household electric water heater, which is also in its promotion stage, although there are many cases here and there where the electric range sale or installation, and also the sale of the electric water heater, or its installation, owing to some peculiar condition, are being satisfactorily taken care of by a live dealer and, in such instances, the dealer is always sure of the co-operation of the central station.

We are told it is not possible for manufacturers to increase the profit to the dealer because there is a limit to the amount the consumer will pay for appliances, and there is a limit to the cost of production and, between these two limits must come the profit for the dealer, the profit for the jobber, and the profit for the manufacturer, after the expense of operation of each branch of distribution is provided for. Therefore, the interests of the manufacturer, jobber, dealer and central station being to a large degree mutual, the responsibility rests upon the central station to use the methods at its command for creating business and stimulating sales in all branches of the industry. There is a growing tendency to increase the price of lamp socket appliances so that the dealer may make the same profit on a small number of sales that he has heretofore made on a larger number. This policy will undoubtedly curtail the number of appliances put out and to that extent delay building up the load factor of the central station.

There has been some talk of a plan to secure uniform action by central stations, jobbers and dealers throughout the country, adopting a national advertising campaign and running seasonal specials, say six specials a year, each for sixty days. This plan has much merit, although the sales policies of all concerns are not the same and it might be that the seasonal specials selected would not be acceptable in each case.

Several large Northern California companies are not in the appliance business directly but are working through the jobbers, contractors and dealers, assisting them financially in their sales efforts. This plan, adopted a year or so ago, is a new departure and definite figures of the results are not yet available, but the experiences of the year have given many valuable points for future sales work.

The methods to be used in creating demand are:

First—Personal solicitation.

Second—Personal letters.

Third—Newspaper publicity.

Fourth—Show window and demonstrations in locations on main shopping streets.

The first method is the best. Personal contact with the prospective purchaser establishes confidence, carries the shopping district of the city right into the home where an attentive salesman is anxious to please, devoting his entire attention to the consumer, thus overcoming the indifference and lack of interest sales people sometimes show when the situation is reversed and the consumer visits the down town store. The central station in following the direct sales method has its prospects boiled down to actual users of electricity and, when the salesman goes to the home, he has a distinct target. In promiscuous advertising and general sales methods, there is estimated to be from 25 per cent to 50 per cent waste. There is considerable value also in the good will which the central station secures by having its representative come in direct contact with the customer every sixty or ninety days, fixing any appliance that may be out of order and attending to or reporting any complaint, thus breaking the clods, removing the weeds and keeping the ground in good, fertile condition. However, there are many who will listen to the central station salesman but buy from the local dealer, the sale coming as a direct result of the company's work. Possibly 15 per cent or 20 per cent would be a fair estimate of this number.

The dealer has found it rather expensive to carry out the personal letter plan. As a partial substitute, the central station is usually willing to enclose with its regular mailing bills, folders and pamphlets advertising appliances of merit and bearing suitable imprint.

Many dealers are using more or less newspaper advertising. The number is increasing and with the National advertising the manufacturers are doing and the display advertising of the central stations ending with the now familiar "For sale by So and So and by

all Electrical Dealers" often giving their names and addresses, a considerable amount of accumulative good is being accomplished.

The real problem of the dealer is how to reduce his expense and increase his sales and it is very gratifying to see the improvement that has taken place in recent years both in show windows and interiors of dealers' stores and to find the dealers getting into a better position to take care of the customers. We observe neat, attractive window displays, tastefully displayed stock, more stores with clerks acquainted with their stock and able to talk their wares in a common sense way and, best of all, more business ability and more intelligent figuring of cost of turn over and cost of doing business.

Such a condition shows decided progress and spells success. With the central station selling at list prices, confining its sales practically to ranges and water heaters, and with the added advantage of selling many of the higher priced articles on installments, made possible through the sales plans of some of the manufacturers, the small dealer has the opportunity of becoming a larger one and the large dealer likewise to become even more substantial, and as he breaks his way through and earns his place among successful business men, the central station will continue to stimulate the demand for the goods he has to sell and find new uses for electrical energy, thus enlarging his opportunities and broadening the scope of manufacturer, jobber, dealer and central station alike.

Among certain jobbers, dealers and contractors as well as among some central station men, there is an opinion that the central station should not handle or sell to its consumers any kind of electrical appliances. Some go so far as to say it is the sole business of the central station to generate, distribute and sell electrical energy and that the sale of all kinds of appliances should be left to others. A wise man has said "The best answer to all criticism; the best test of all work, is results." The science of load building is as much the duty of central station men as the generating of electrical energy. The improving of load factor and diversity factor, is absolutely essential to the well developed electric property. If the central station does not guide and control this important work, who is going to do it? We are measured by results and where the best results are obtained, the central station is developing its own business, as well as extending active co-operation to the manufacturer, jobber and dealer.

USEFUL MINERALS OF THE UNITED STATES

A new edition of the popular work entitled "Useful Minerals of the United States," is being published by the United States Geological Survey, Department of the Interior, as Bulletin 624. It is a revised, enlarged and up-to-date edition of a bulletin that was issued about two years ago. A large edition of that bulletin was published, but it soon became exhausted, and several thousand applications for it were received after the edition printed had been distributed.

Besides giving several thousand new localities of mineral deposits and adding more than 160 new mineral names to the glossary, the new bulletin furnishes considerable additional information concerning certain minerals, especially the uranium and vanadium minerals found in the high plateau region of the West.

COMPARATIVE SUMMARY OF CRUDE PETROLEUM MOVEMENT

The following comparative summary of crude petroleum movement in January, 1917, represents the operations of 91 pipe line and refining companies, who handle or receive oil from the various productive fields east of the Rocky Mountains, and is compiled from reports received by the United States Geological Survey, Department of the Interior, prior to February 27, 1917.

Crude Petroleum Moved From Field Sources

Barrels of 42 gals. each

Field	Jan. 1917	Dec. 1916	Jan. 1916
Appalachian	1,682,615	1,642,838	1,434,149
Lima-Indiana	287,999	251,134	274,293
Illinois	1,433,528	1,413,075	1,372,290
Oklahoma-Kansas	7,436,010	7,330,529	5,971,030
Central and North Texas	783,987	.....	.....
North Louisiana	.....	.....	.....
Gulf Coast	.....	.....	.....
Rocky Mountain	868,357	.....	.....

Crude Petroleum Delivered to Refineries or Consumers

Barrels of 42 gals. each

Field	Jan. 1917	Dec. 1916	Jan. 1916
Appalachian	2,206,642	2,111,567	1,919,649
Lima-Indiana	1,578,884	1,521,962	1,696,319
Illinois	540,907	502,548	544,019
Oklahoma-Kansas	4,006,295	.....	.....
Central and North Texas	821,277	.....	.....
North Louisiana	.....	.....	.....
Gulf Coast	.....	.....	.....
Rocky Mountain	589,779	.....	.....

Stocks of Crude Petroleum at End of Month

Barrels of 42 gals. each

Field	Jan. 1917	Dec. 1916	Jan. 1916
Appalachian	6,401,474	6,364,144	7,174,434
Lima-Indiana	3,794,289	4,122,779	4,498,166
Illinois	5,214,527	5,555,444	9,321,491
Oklahoma-Kansas	17,396,695	12,543,712	5,102,218
Central and North Texas	2,520,004	.....	.....
North Louisiana	.....	.....	.....
Gulf Coast	.....	.....	.....
Rocky Mountain	860,926	.....	.....

CO-OPERATION IN FOREIGN TRADE

Important excerpts may be gleaned from a recent address by E. N. Hurley, chairman of the Federal Trade Commission before the Commercial Club of Chicago:

Nowhere is co-operation among business men and between them and the government more essential than in the development of our export trade. For this reason, the Federal Trade Commission has urged upon Congress the importance of the passage of the Webb bill, which removes the doubt which now exists in the minds of many business men as to the application of the anti-trust laws to co-operative selling agencies or associations organized solely for the purpose of furthering our export trade. This bill has passed the House of Representatives by a large non-partisan vote, and was pending in the Senate, when the filibustering movement killed it in the closing hours of the last session of Congress.

General Weighing by the government of the United States mail carried on all American railroads commenced on March 27th and continues for thirty-five days. The ton-mile or weight has been the basis of mail pay ever since the roads began carrying the mails. The present postal administration advocates a change from that method to one by the car-foot-mile, or space basis.

ELECTRIC COOKING AND HEATING

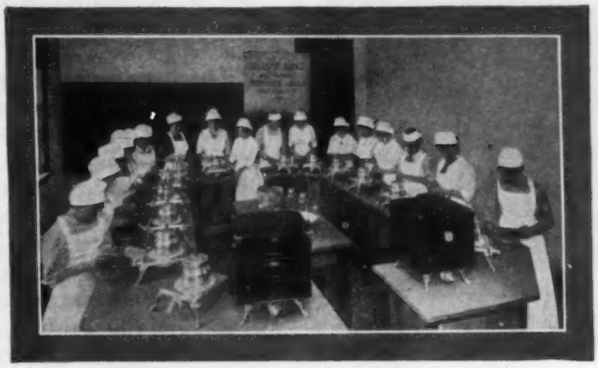
(Electric cooking and water heating continue to engage the thoughtful attention of commercial departments of power companies of the West. The industrial applications of electric heating are also widening each day so that new ideas of presentation and new methods of organization are constantly being evolved to meet the problems that are continually arising. Here is an article by a member of the commercial staff of the Great Western Power Company and a second article by the head of the commercial department of the San Diego Consolidated Gas & Electric Company which should prove timely aids for such commercial campaigns. These papers are parts of the report of the Commercial Committee and are to be presented for discussion at the convention of the Pacific Coast Section of N. E. L. A.—The Editor.)

ELECTRIC COOKING AND WATER HEATING

BY J. B. BLACK

It is the sense of the committee that at the present time an elaborate and detailed report on the Range and Water-heater situation on the Pacific Coast is not in order. This decision is based on the fact that the Electric Range Report presented at the convention of the Northwestern Electric Light & Power Association in Seattle, in 1916, and the report of the Electric Range Committee presented at the National Electric Light Association Convention in Chicago, in 1916, have brought the fundamental points of progress practically up to date and there is very little to be added to them.

This branch of the electrical industry on the Pacific Coast has, of course, made progress during the past year, particularly in the development of the water-heater situation, but such progress has not taken the form of fundamental changes but has been more in the nature of a general working out and refinement of the principles already developed.



Training the Future Housewives in the Method Electrical—Domestic Science Classroom, Westminster College, Salt Lake City

It was the thought that, inasmuch as both copies of the above-mentioned excellent reports are in the hands of practically all of the Pacific Coast Section members, the year's progress could be brought out to better advantage by a full discussion in the convention meeting rather than by the preparation of an elaborate report.

The tests on water heaters made by the Pacific Gas & Electric Company, in connection with the report of the Electric Range Committee of the Northwest Electric Light & Power Association, together with certain tests on a thermally controlled heater by the Great Western Power Company, are included as data additional to that published in the Seattle and Chicago reports.

The range and water-heater situation in general is still one of the most intense interest, to practically all of the Pacific Coast Operating Companies, and while the methods of merchandising and of charging for the service rendered vary a great deal, the ultimate result—that of making the electric kitchen standard—is well on the road to accomplishment.

Advertising.—There is considerable difference of opinion as to the value of advertising in introducing electric cooking and water-heating. Many of the member companies have used stuffers and pamphlets, as well as newspapers and other advertising mediums, with varying and in some cases indeterminate results; but it is apparently unanimous that advertising while of certain value as an interest awakener is absolutely valueless unless handled as a helper to an energetic house to house campaign.

Electric Cooking.—Considerable improvement has been made by the electric range manufacturers in the quality of their product. Generally this improvement has taken the form of more substantial element supports, better quality and placing of elements, aluminizing or in some way preventing the formation of rust in the ovens, and a general strengthening of the weak spots which have developed.

Some of the manufacturers have shown a commendable spirit of co-operation with the central stations by going over the range installations in general and noting points at which trouble has developed. The result of this get-together spirit is reflected in the changes made in range design, which have tended in a large degree to eliminate many of the earlier troubles. Due to the many types of electric ranges on the market, the consumers' requirements are taken care of remarkably well. In fact, many of the central stations have seen fit to choose several of the more popular types and concentrate on their sale to the exclusion of all others. This method not only materially cuts down the stock investment for the central stations, but enables them to reward the progressive manufacturer and also to make the salesman's task easier by enabling him to concentrate his effort.

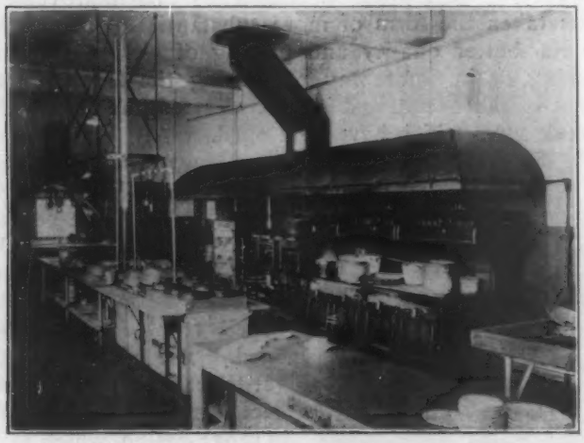
The question of voltage regulation is rapidly gaining the importance which it deserves, and the problem of Service, particularly in the rural districts, is more than ever vital.

There has been very little change in the attitude of the manufacturers or central station men in their preference for the open or closed type of elements, both of which have their adherents.

The rapidly increasing price of electric equipment, of course, multiplies the difficulties of the range salesman, and it is particularly important to the company just commencing sales activity in the range line to have the first cost of the electric installation as near

as possible to that of gas or coal equipment. Many of the central stations have found that it is advantageous to sell the range "installed," and it has been the general practice to turn over the range and make the installation at actual cost to the company. In some cases the company has even seen its way clear to make the installation at less than cost. The general tendency, however, seems to be to gradually raise the price of the range equipment to the standard list price at which the dealer operates. This may indicate possibly that the time is approaching when the central stations will be able to turn the merchandising of electrical ranges and water heaters over to the dealer, but certainly the time is not yet ripe, and the central stations will have to look forward to several years more of expensive development work before they can with safety withdraw entirely from the merchandising field.

Water-Heating.—The question of heating water electrically, and particularly in connection with electric range installations, is still characterized by a wide



Typical Electric Ranges and Broilers in Commercial Cooking

divergence of opinion among central station men. There is, however, a decided trend in the direction of placing the water-heating business, properly handled, on a par with the electric cooking business. From the standpoint of value to the central station a combination of the two is considered ideal, and in fact opinions have been expressed that the water-heating business alone (always assuming that it is properly handled) is even more valuable to the central station than the cooking business alone when considered from a standpoint of the sales effort needed, annual income per kilowatt, and the resultant load characteristics.

The vital problem lies, of course, in keeping the water-heating load off the range peaks. Two different methods of obtaining this result have been developed: First, placing the heater on a double-throw switch with the range, and second, employing the use of a thermally controlled "step type" heater operating directly on the line. This latter type of heater is finding greater favor recently, and it is particularly suited for working in parallel with a solar heater or the ordinary water-back installed in a furnace, or fireplace.

The two most important faults of the ordinary immersion or circulation type heater when installed on a double-throw switch with the range, are overheating or underheating due to abnormal or subnormal use of the range equipment by the housewife. These faults are completely overcome by the thermally controlled heater, and providing the load characteristics are such that the large water-heating demands will not coincide with the demands of the range, the thermally controlled heater will approach nearer to the ideal automatic electric kitchen, towards which we are striving, though due consideration must be given to the larger radiation losses when this type is used.

The question as to the use of the flat or meter water-heating rate is still an open one, and must be settled by each company in a way that will best fit its operating conditions.

When the water-heater is placed on a meter rate, it is very important to the consumer and ultimately to the central stations that every possible method of economizing in the use of electric energy be used.

The investigation and application of electric water-heating has lagged behind that of electric cooking, and it is very desirable that a full discussion of its merits and the problems to be met be invited at the convention.

The relation of storage capacity to the rate of use of water in the various classes of service to which electric water-heating may be successfully applied, and also the relation of storage to the kilowatt capacity, are of great importance, and probably more real advance in the solution of these problems has been noted than in any other phase of electric water-heating progress.

The installation of spring faucets, lagging, and a complete survey of both the plumbing installation and the habits of the various classes of domestic and commercial consumers must be made and allowed for in order to insure satisfactory service. This survey is particularly essential when the installation of a thermally-controlled heater on a meter basis is contemplated, as a very thorough study must be made in order to insure the resultant load characteristics which will enable the central station to grant the service the low rate which is necessary in order to make electric water-heating universally practicable to the consumer and at the same time profitable to the central station.

It is the opinion of the committee, that we are all more or less overlooking the importance of insulation in our study of the water-heating subject. Plant tests indicate that while the manufacturers are giving us a number of very reliable heaters, we have very few convenient and economical methods of insulating boilers and piping. We believe that from now on more attention should be given to this phase of the subject. If more of the losses can be eliminated it will go a long way toward solving the problem.

In the last report of the U. S. Bureau of Standards, it was announced that the most extensively used domestic commodity was matches; following it, a close second, came hot water. With the introduction of the electric range we like to think that we have effectively eliminated matches from the home. Having done this, the next problem of greatest importance to the householder is then hot water.

INDUSTRIAL ELECTRIC HEATING

BY A. E. HOLLOWAY
Commercial Manager, San Diego Consolidated Gas & Electric Company

Industrial electrical heating includes all the industrial applications of electricity in which electrical energy is converted directly into heat. This is a broad field and the possibilities of its development are unlimited.

Problems of Development.—The direct conversion of electric energy into heat is as old as the electrical industry, but the development of its application to industrial purposes has been very slow. The central station has been backward in exploiting industrial heating for the following reasons:

First—The absence of rate schedules that would be attractive to the customer and give a profit to the central station.

Second—The rapid development of the central station load due to power and lighting improvements calling for the entire attention of the manufacturers and central stations.

Third—The impossibility of standardizing apparatus or devices. A device successfully operated on one kind of work may not be applicable to the same kind of work for a similar manufactured product in another establishment, due to difference in size, degree of heat, etc.

Fourth—The direct comparison of the cost of heat units produced by electricity as compared with those of oil, gas or other fuels.

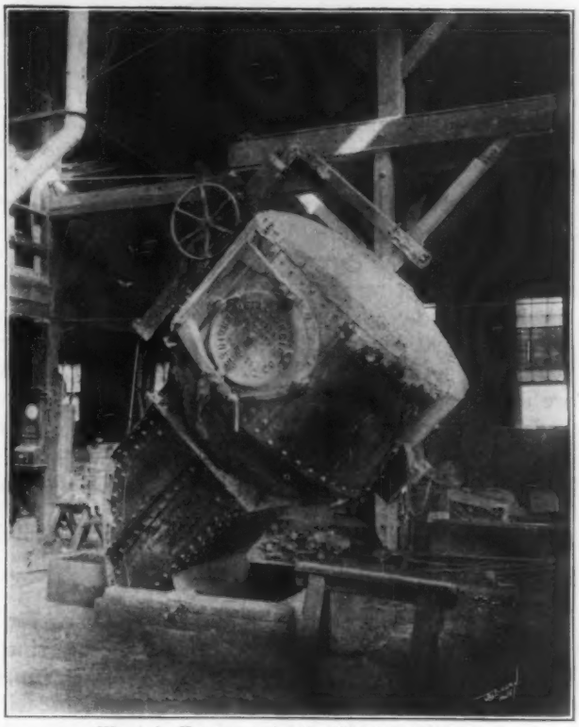
Fifth—The difficulty in demonstrating to the customer the convenience and economy to be found in the use of electric heat.

Sixth—The fact that each individual installation is an individual problem and must have individual attention from the central station salesman.

The prospective customer's first question is "What is the first cost?" His second question, "What is the cost of operation?" The first cost is not usually a serious obstacle but the cost of operation and maintenance needs careful consideration. Each proposition necessarily becomes an individual one and delays in making tests and cost estimation by the central station or the manufacturer often mean the loss of the prospect who resorts to the old methods which he knows will produce fairly good results.

What has Been Done to Develop the Heating Load.—Standard heating units have been developed by the manufacturing companies which can be used in many instances without modifications and they are at the present time developing new apparatus. This development work is rather expensive and most of it has been accomplished through the direct demand of the customer rather than by its exploitation by the central station and the manufacturer. We can name a great number of industrial heating installations which have been tried out and have proven successful, such as the enamelling oven, which is used both on a large and small scale, the electric furnace for high grade castings, glue pots and glue cookers for wood-working, soldering irons, core-baking ovens, welding machinery and many others.

At the present time the central stations have a great many proven industrial devices which they can exploit. By becoming familiar with and by introducing these appliances to the public, they will be able to more thoroughly study the industrial heating field for new applications for the manufacturers to develop. This will naturally, in the course of time, lead to a greater development of industrial heating. It is necessary that the manufacturers and central stations co-operate in giving to the customer the very best service possible and to help him solve his manufacturing problems in the electrical way. It is also essential that the central stations co-operate by furnishing each other information on installations which have proven successful. In the appendix to this paper will be found a list of industrial applications on which information



Electric Furnaces in the Steel Industries

is now available and which has been compiled by the manufacturers.

Points to be Taken Into Consideration in Industrial Electrical Heating.—There are numerous industries that use heat in some process of their manufacturing operation. In many cases, electric heat would prove more economical than any other form. In considering the advantages of electric heat, the following points of superiority must be kept in mind: chances for economy, ease of application, improvement of product, saving of labor and skill, accurate temperature adjustment, possibility of effecting operations otherwise impossible, reduction of floor space, absence of unhealthy products of combustion, lack of excessive room temperature, removal of fire and explosion risk, increased comfort, quicker and more efficient application and flexibility of operation.

In almost all cases on approaching a heating problem, we find that the heat units produced by electrical energy, as compared with the same amount produced by gas or oil, will cost considerably more; but it does not always follow that heating by gas or oil is the more economical. It is very essential to make a study of the proposed installations in order to get the proper appli-

cation of the electrical energy and it is necessary to become familiar with the requirements of your customer and with the method of manufacturing his product. It is often very hard to establish the prospective customer's confidence in electric service and to get him to change his methods and make new expenditures while he is getting along fairly well with his present system. It is the central station's greatest problem to prove to the prospective customer that by using electric heat his unit cost of production will be less in the end when at first appearance it would seem much higher.

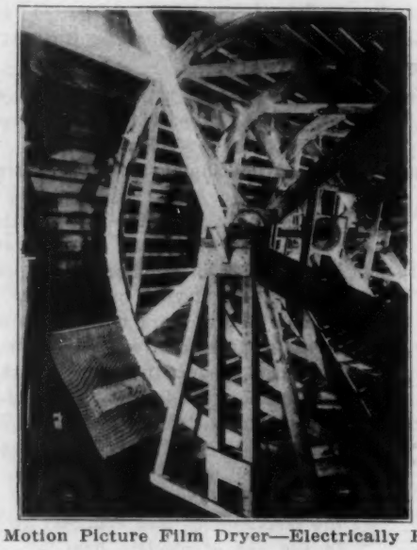
Let us take for example the electric enamelling oven. Looking at the problem by comparing the cost of heat units produced by electric energy with the cost of those produced by other fuels, it would seem prohibitive to use electric heat. But taking into consideration that, due to the fact that the available heat is directly applied in useful work and it is not necessary to baffle or muffle to secure uniform heating, the electric oven insures a greater production with lower unit cost, inasmuch as the enamel can be baked from thirty to forty per cent faster. Furthermore, ventilation is not required to take care of gases of combustion, only a small amount being required for the escape of vapors and which can be entirely shut off as the temperature rises. The heat being furnished by radiation as well as convection makes the baking much faster, being more direct. The finished product surpasses that produced by gas or oil and it has a finer finish due to the complete absence of products of combustion. The electric heat further presents control which is automatic, eliminates the danger of explosion and insures a perfect job. With these considerations, the electric enamelling oven has proven the most economical.

There is no doubt at the present time, the cost of electric heat is prohibitive when applied to some industries,—unless a very low rate for energy be obtained. Either the application or the conservation of heat must be accomplished to a greater advantage than with other fuels or there is very little chance of securing the load. Every application made of electric service in the industrial field will be watched with great interest and therefore great care should be exercised in making careful recommendations where it is apparent that the advantages to be gained by the use of electric heat will not outweigh the economy to be effected by the adoption of fuels of low cost and high heating value.

It is necessary in making installations to see that the apparatus is properly installed and insures good service. The most important points to be considered are first, the proper application of the heat, and second, the conservation of the heat by means of perfect insulation. A successful installation will open up a wide field and an unsuccessful one may close a promising field.

How and Where to Secure the Industrial Heating Business.—Prospects for industrial heating will be found in the territory of every central station and its development depends upon the amount of time and study the central station will give in proving its right to obtain this load. It must not be expected that great results will be attained immediately but with the proper study of the field by the central station, together with the assistance of the manufacturing company, a great deal can be accomplished. Electric heating can be secured very easily in some industries by merely acquainting the prospect with its advantages. Examples of this are found where there is great fire hazard, where there is danger of explosion, where long and expensive steam lines are maintained for small amounts of heat or steam, and where the application of heat is difficult.

Laundries are always good prospects for electric irons and oftentimes the central station can secure the ironing load of a laundry where it cannot secure the power load, as it is more economical for the laundry



The Motion Picture Film Dryer—Electrically Heated

to buy the electric energy rather than to generate. There can be found in every town a field for small enamelling ovens of from three to ten kilowatts capacity. At the present time the work is sent to the larger cities with great waste of time and money, whereas the installation of a small oven would enable the work to be done in the shop with the advantage of lower cost and better service. In towns with foundries, electricity for core baking ovens has the advantage over other fuels in uniform temperature, conservation of heat, speed, and the elimination of imperfectly baked cores; in other words, a much more uniform product can be procured.

It would be well for every power salesman to become thoroughly acquainted with the processes used and the equipment of power users. He should go into the shop or factory and suggest the advantages of electric heating when he himself is convinced that a change would improve conditions and be profitable to the customer in the end. This is a problem for the power salesman to solve, and by doing this, one use of electric heat will be the forerunner of another. Also the salesman will often times find the customer suggesting his own use. There is one thing about which every salesman of industrial heating must be careful, that is the selling of an appliance or installation to his customer which he himself knows will not be of any benefit to the customer or which will not better his operating conditions. It is essential that the salesman be truthful and if he does not believe he can better the customer's condition, he should recommend against the use of electrical apparatus and not lead the prospect into purchasing something which he himself knows will be unsatisfactory.

The committee finds that in addition to the uses mentioned by Mr. Holloway, where electric heating has proven entirely satisfactory, we should mention commercial bakeries. There are many now in operation in various cities, Salt Lake City probably having more than any other one city.

Attention might be called also to two electric furnaces installed in the Monarch Foundry and the Sampson Iron Works in Stockton, California, and another installed at the plant of the Enterprise Foundry Company in South San Francisco, California. These are new installations and no data is available at the present time.

FIFTY INDUSTRIAL APPLICATIONS FOR ELECTRIC HEATING

Bacteriological incubators, beer vat dryers, bookbinders' heaters and gelding wheels, branding discs.

Can capping machines, candy batch and chocolate warmers, celluloid embossers.

Electric furnaces, embossing press heaters, envelope gum dryers, enamelling and japanning ovens.

Fan drying equipments, foot warmers.

Glue pots and cookers.

Hood heaters. Hardening furnaces.

Instrument sterilizers, incubators.

Laboratory heating devices, laundry machinery and rolls, linotype metal melting pots.

Matrix dryers, metal melters, motion picture film dryer.

Oil tempering baths and compound melters.

Pallette die heaters, pallette ovens, paper seal moisteners, peanut roasters and heaters, photographic drying ovens, pitch kettles, pleating machines for dress goods.

Rectifier tube boilers, roofing material vulcanizer, roofing paper heaters.

Sealing wax pots, shoe relasters, soldering irons, solder pots, solution tanks, steam boilers, stills for distillation of water, swimming tanks.

Tailors' irons, thread wax heaters, tire vulcanizers.

Varnish tanks, vat dryers, velvet marking irons.

Welding outfits.

POINTERS INVOLVED IN ELECTRIC HEATING INSTALLATIONS

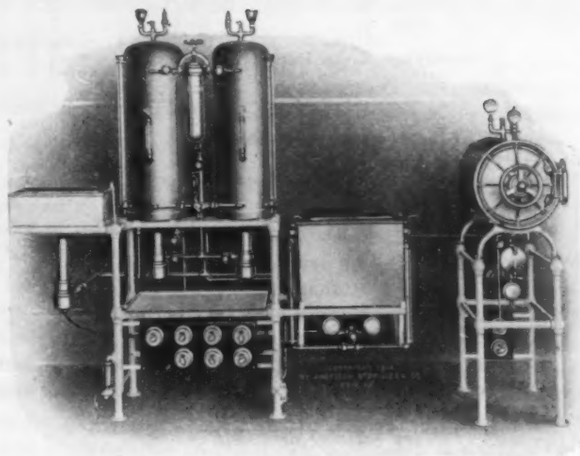
The following are a few items to be taken into consideration in making an installation of electric heating:

Problems Involved in the Heating of Water or Other Liquid

1. Amount of liquid.
2. Period of time for heating up.
3. Material of containing vessel.
4. Temperature maintained.
5. Whether vessel is insulated from radiation losses or can be so insulated. Kind and thickness of insulation.
6. Exterior surface of vessel (light or dark, rough or polished).
7. Kind of liquid.
8. Whether top of vessel is or may be covered.
9. Size and shape of vessel and space allowed for heater.
10. General operating conditions and special or unusual features.

Problems Involved in Steam Generation

1. Steam pressure desired.
2. Quantity of steam in pounds per hour.
3. Time allowed for bringing up to pressure from cold.
4. Detailed description of boiler to be heated with dimensions and construction.
5. General operating conditions and special or unusual features.



Typical Sterilizer Installation. (Left to right—Instrument, Water, Utensil, and Dressing Sterilizers)

Problems Having to Do With Japanning, Enameling and Other Baking Operations

1. Size of oven.
2. Shape of oven.
3. Temperature to be maintained.
4. Cycle of heating operation.
5. Weight of material to be baked.
6. How material is handled.
7. Duration of process.
8. Outside temperature of present oven.
9. Weight of trucks carrying material into oven.
10. Number of bakes required to produce finished product.
11. General operating conditions and special or unusual features.

Problems Involved in the Application of Electric Furnaces

1. Size and shape of chamber required.
2. Kind and quantity of work to be done.
3. Maximum temperature required.
4. General operating conditions and special or unusual features.

All Problems Involving the Application of Electirc Heat

1. Type of apparatus now being used.
2. Present cost of operation.
3. Amount of work to be done.
4. Present operating conditions and special or unusual features.

INTERESTING INSTALLATIONS OF INDUSTRIAL ELECTRICAL HEATING

Ford Motor Company—Enameling Ovens

Location: Los Angeles.

Size: Two ovens, 8 ft. by 8 ft. by 24 ft., approximately.

Temperature: Inside temperature 375° F.

Capacity: Heating elements, 225 kw. each.

Output: Average of 205 tons of auto fenders are baked in these ovens per month. Average consumption 45,000 kw. hr. per month, or approximately 220 kw.-hr. per ton.

Fenders are dipped in enamel at a temperature of approximately 60° F. and are baked to an excellent finish in about 45 minutes.

When work is heated in an oil or gas furnace, it is almost entirely by convection. With the electric furnace the heat is given off partly by convection, but mainly by radiation in which the heat travels more rapidly and penetrates more completely.

Economy demands that the oven be effectively heat insulated and its interior walls be of low thermal capacity. The ventilation should be practically all cut off when the

work has reached a certain temperature to increase the efficiency of the oven.

Goodyear Shoe Repairing Company

Location: San Diego.
Appliance: Goodyear shoe stitcher.
Number of heat units: Three—
1. Thread heater.
2. Wax heater.
3. Bobbin warmer.
Control: Rheostat resistance.
Watts connected: Maximum, 400.
Minimum, 300.
Monthly, 150 kw.-hr. consumed.
Advantages: Absolutely constant heat. No boiler necessary as with gas. Faster to start, 15 to 20 minutes with boiler. More simple. Enclosed, dirt and grit being thus kept out of working parts.
Operation: Very satisfactory.

O. K. Tailor Shop

Location: San Diego.
Appliance: Pressing machine.
Manufacturer: Edwards Mfg. Co., Cincinnati, Ohio.
Number of heat units: One.
Control: 3 point switch.
Watts connected: Maximum, 3300.
Minimum, approximately, 1100.
Average consumption: 400 kw. per month.
Advantages: No odor.
Cleaner.
Less fire risk.
More convenient.

Western Lumber Company

Location: San Diego.
Use: Heating lumber preparatory to glueing.
Size: 2 ft. 6 in. by 2 ft. 6 in. by 10 ft.
Construction: 1 in. doubled with building paper between asbestos paper on bottom only.
Connected load: 2000 watts.
Inside temperature: 157° F.
Used to warm kiln-dried hardwood.

California Organ Manufacturing Company

Location: Van Nuys, California.
Use: Heating lumber preparatory to glueing.
Size: 2 3½ ft. by 3½ ft. by 16 ft. and 1 3 ft. by 4 ft. by 6 ft.
Construction of box: Galvanized iron with a 2 in. magnesia covering.
Kilowatt hour consumption: 55-75 kw.-hr., per 24 hours for three boxes.
Radiation Losses: 4.83 to 5.23 watts per sq. ft. of outside surface of box.
Inside Temperature: 158° F.
This is not used for drying lumber but to warm kiln-dried hardwood before applying glue.
Conditions could be materially improved by increasing lagging and painting inside with white enamel.

The Warman Steel Casting Company

Location: Redondo Beach.
Installation: One Stassano 3-phase electric furnace.

The equipment consists of a steel shell about fourteen feet in diameter and fourteen feet high, lined next to the steel with silicon brick and next to the metal with magnacite brick. Magnacite brick is necessary for the interior lining as the metal bath comes directly in contact with the furnace lining and magnacite is a neutral material, while the silicon brick has an acid base and is also unable to withstand the intense heat some 3500 degrees, Fahrenheit. The furnace is suspended on a double set of trunnions, the two sets being opposed so the furnace can be rocked or rotated, and the last five minutes of the heat the metal is agitated for the purpose of expelling any gases held in suspension so that when the metal is poured into the molds there will be no blow holes in the castings.

The electrodes are introduced through the lining on the sides of the furnace and are carbon, three and one-half inches in diameter and six feet in length. These carbons cost in the neighborhood of three dollars apiece, and while the furnace is hot, they last but twenty-four hours regardless of the amount of metal melted down.

The carbons are held in a long steel tube carbon holder that is surrounded by a cast iron water jacket and the electrode is advanced or withdrawn by being fixed to a hydraulic ram. Each electrode is controlled by a valve controlled by an operator constantly on duty while the furnace is kept hot, and once the furnace is warmed up, it must never be allowed to be cooled off during the life of the lining, as the cooling down of the furnace to a low temperature cracks the lining beyond repair and it would have to be torn out and replaced at an expense of about $400.

The above cost, together with the loss of a ton of metal, should it freeze up, through long extended interruption of service, is the principal reason for the great necessity of continuous service.

The lining is put in and when heated up under constant heat will last about fourteen days regardless of the number of charges of metal drawn off. Attached to the end of the carbon holders are 100,000 circular mill cables leading to a switchboard on which are mounted double throw switches, and the transformer connections can be so manipulated on the board that the furnace can be operated at 110 or 150 volts by changing from the delta connection to the "Y" connection on the secondary side.

The transformer capacity consists of three 100 kilowatt transformers with a ratio of 10,000 to 110-150 volts and are connected to the switchboard with busbar copper of a capacity sufficient to carry 1500 amperes.

The operator controlling the valves that move the electrodes back and forth, sits facing three ampere meters having a range of 2000 amperes, and he regulates the electrodes to keep the current within the range of from 800 to 1200 amperes. The ammeter guides him in his manipulation of the electrodes.

The average demand is about 225 kilowatts and draws about as follows:

At two or three o'clock in the afternoon the second heat is pulled off and then to keep the furnace warm until the next charge is put in, the furnace comes on for fifteen minutes, and then is off forty-five minutes. This operation is kept up from three in the afternoon until about four in the following morning. At four in the morning, part of the charge of metal is put in the furnace and melted down and from that time on at intervals of a few minutes the balance of the metal is introduced until 2000 pounds in all have been put in the furnace and brought to a molten state.

From the time the furnace is charged until the charge is poured off into the ladels the current is on continuously and the amount of time required to bring the metal to the proper condition seems to vary for some unknown reason and run from three and one-half to five and one-half hours.

The average kilowatt consumption for the reduction of one ton of metal is about 1100 kilowatt hours, and in spite of the fact that only two heats are drawn off each day and no heats taken off Sundays, the actual operation of the furnaces is about nine hours out of twenty-four and for that six men are continuously in attendance, two at a time on eight hour shifts, regulating the electrodes to keep the furnace heated during the fourteen days of its continuous run. One set of carbons is consumed each twenty-four hours regardless of the number of heats taken off.

N. E. L. A. COMMITTEE REPORTS

(The papers that comprise the subjects for discussion at the convention of the Pacific Coast Section of the N. E. L. A. have been arranged through the effective work of the commercial and engineering committees. With the exception of the paper on "Exhaustive Tests on Electric Water Heaters," by the commercial committee, which appeared in the columns of the Journal of Electricity in its issue of April 1, 1917, all of the papers that are to be presented at the convention may be found in this issue. By reference to the Table of Contents on page 322, any particular discussion desired may be readily found.—The Editor.)

GENERAL NOTATIONS ON PACIFIC COAST SECTION N. E. L. A. MEMBERSHIP

The first convention of the recently organized Pacific Coast Section of the National Electric Light Association, which now numbers over thirteen hundred members, and is the largest geographic section in the country, will assemble at Riverside, California, on April 19th for a three-day meeting. It will be attended by representatives of 49 electric light companies in the territory embraced by the States of California, Arizona, Nevada and New Mexico. Its membership represents an invested capital of approximately $500,000,000 with a gross revenue during the year 1916 of approximately $50,000,000. In the territory mentioned there are 73 hydroelectric plants, with an aggregate installed capacity of 600,000 h.p., and 21 steam plants with an aggregate installed capcity of 425,000 h.p., and with a connected load of approximately 2,000,000 h.p. The population served approximates 4,000,000 people.

The main purpose of this convention will be to provide ways and means for bringing electric service up to the highest possible point of efficiency, as well as at a minimum of cost to the public served, and to discuss all matters pertaining to the industry. One of the most important matters to be taken up will be the report of the Public Policy Committee, of which John A. Britton of San Francisco is chairman. The aims and objects of this committee are to thoroughly analyze all matters having to do with the public service, that is, in regard to the character of service furnished and the rates charged therefor, and to consider and advise upon legislation enacted by the State Railroad Commission and other regulating bodies

REPORT OF THE COMMERCIAL COMMITTEE, PACIFIC COAST SECTION, N. E. L. A., RIVERSIDE, CAL., APRIL 19-22, 1917

Your committee had very little time to prepare this report as the appointments were not made until about February 1st. Two meetings were held, one in San Francisco on February 14th, and the second in Los Angeles on March 16th, practically an entire day being devoted to each meeting.

At each meeting all the members but one were present, the absentee being a different one in each case. At each meeting we were fortunate in having with us for a short time our Section Chairman, Mr. Ballard, and some of the other officers and committee chairmen, so that our deliberations were participated in by a very representative set of men. We hope our conclusions and recommendations will therefore be given due consideration.

Owing to the short time between the dates of our appointment and the Riverside Convention, we did not feel that we could go into the matter exhaustively, and decided that our report should consist of a general survey of conditions as they exist, such recommendations as we care to make for action at this convention and suggestions of the work to be carried out by next year's committee; our thought being to bring out the points that will promote real discussion at the Riverside meeting.

For convenience both in the preparation and use of the report, the work has been divided into six subjects, and each subject assigned to a member of the committee, with the idea that the discussion will follow in the same order.

1. Rates, by H. A. Lemmon of Reno.
2. Merchandising, by A. W. Childs of Los Angeles.
3. Electric Cooking and Water Heating, by J. B. Black of San Francisco.
4. Industrial Heating, by A. E. Holloway of San Diego.
5. Highway Lighting, by E. B. Walthall of Fresno.
6. Commercial Organization, by E. B. Criddle of Riverside.

Each member presented his subject at the Los Angeles meeting for discussion, and each subject is added hereto practically as presented at that time, together with the conclusions and recommendations of the whole committee.

Mr. Lemmon who has the subject of rates in charge has assembled the rate schedules of practically all the member companies, together with the rules and regulations. There is a noticeable difference both as to form and quantity which is probably to be expected among companies operating under such varying conditions, but it is hoped that certain standards of form at least will be arrived at in due time that will be of assistance particularly to the smaller companies.

It was the sense of the committee that the member companies be asked to send to the secretary's office enough copies of existing rate schedules and rules and regulations so that the secretary can provide each member company with a complete set, and furthermore, that new rates as they are adopted from time to time be sent to the secretary so that he can keep each member company's book up to date. This recommendation is made with the knowledge that the National Electric Light Association has just issued a rate book containing rates of all companies in the United States serving towns having a population of 40,000 and over, which book we do not consider fills the wants of this Section as four-fifths of its member companies are not covered.

In order to provide for discussion on this subject we felt it advisable to have a paper, and W. G. Vincent, valuation engineer of the Pacific Gas & Electric Company, has prepared a paper on this subject.

The paper on Highway Lighting includes a complete plan for the organization of lighting districts, in accordance with the laws of California. The advantages of boosting this class of business, both from the point of view of the central stations and the manufacturers and dealers, are obvious.

In addition to the duties assigned to the Commercial Organization by Mr. Criddle, as set forth in his paper, attention is called to the fact that it is found advantageous to have the matter of adjusting consumers' bills come under his committee, and it is the sense of the committee that this be included.

The committee is unanimous in suggesting the adoption of some plan whereby the smaller operating companies can get more direct benefit from membership in the Pacific Coast Section of the N. E. L. A., and it is the decided recommendation of the committee that the secretary's office be considered the clearing house through which the small companies can obtain competent salesmen when desired, from the larger companies. This plan will not only be of great assistance to the smaller companies, of which there are thirty-eight in the Pacific Coast Section, as against twelve of what would be termed larger companies, but will also directly benefit the larger companies by giving them an opportunity to send men out in the other districts for short periods to get experience that they could not get in their own companies. It is evident that if the association is to thrive it must be of value to every member, and if the smaller member companies realize that through the secretary's office, as a permanent organization they can get help at any time and on any subject, they will be quicker to see the benefit of active membership.

It is the sense of the committee that the member companies of the Pacific Coast Section get solidly behind the dealer and contractor movement, support the California State Association of Contractors and Dealers by helping it to create a fund for handling its work to better advantage, including the employment of a competent field man, and take advantage of the large volume of advertising, both national and local, already in the field, to the end that the central station of this territory may get the benefit to the fullest extent, of all elements that go to make up the industry.

We believe that the electric cooking and water heating subject is one of the most important before the member companies at this time, and urge that this subject be given full consideration in next year's activities. We purposely have not mentioned in this report any details in connection with this subject, except the laboratory tests, as we did not have the time to make a proper investigation and have refrained from commenting on the number of ranges and water heaters installed by the member companies, of which there are a great number, particularly among the companies in the southern part of California.

We believe that the member companies will benefit by fuller co-operation with the organization of contractors and dealers, with the thought in mind that in the contractors and dealers the central stations have active and energetic salesmen without the necessity of having these men on their pay rolls. We believe the time will come when the central stations can leave the merchandising subject entirely in the hands of the dealers, with such supervision as must naturally be exercised by the central stations to get the best results for all interests.

We wish to express our appreciation to the member companies and to others for the promptness and courtesy they have shown us in replying to our requests for information, and we believe the spirit of co-operation shown in this way indicates that all the member companies are alive to the value of this association.

In conclusion, we desire to call attention to the importance of having the work of the commercial committee continuous, and we believe this can be carried out through the secretary's office. We further recommend, in addition to such recommendations that have been made on each of the subjects in this report, that attention be given to the printing, in handy form for use, of a rate book containing all the rates and rules and regulations of the member companies, and that next year's committee give particular attention to the question of arriving at some standards as to forms for rates.

S. V. Walton, chairman; H. L. Aller, J. B. Black, A. W. Childs, E. B. Criddle, A. E. Holoway, H. E. Lemmon, E. B. Walthal, R. M. Alvord, D. E. Harris, J. W. Redpath,

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REPORT OF ENGINEERING COMMITTEE

This committee was appointed by President Ballard on January 17, 1917, with instructions to make a general survey of the engineering situation, reporting conditions as they exist, with recommendations for the future.

In the limited time available between that date and the preparation of this report, the committee has attempted to collect information for the consideration of the Section on subjects of greatest local interest, eliminating as far as possible subjects of greater interest to other sections. The committee has also outlined some future work, in which we should appreciate the co-operation and assistance of the engineering departments of the member companies. We should also appreciate recommendations on other work which may be desired by the Section.

Transformer Standardization

We have co-operated with the apparatus committee of the national body in an endeavor to standardize the size, nominal voltages, voltage ratios, taps and series multiple arrangements of the various lines of transformers, particularly distribution transformers. Before the organization of this committee, Mr. S. J. Lisberger was engaged in this work as a member of the apparatus committee of the national body. Members of this committee and other distribution engineers went into this matter thoroughly with Mr. Lisberger in meetings in San Francisco and Los Angeles in February, after which Mr. Lisberger went East and attended a meeting of the national committee, with the result that the needs of this Section were ably presented and recognized in the new standard line, par-

ticularly in the distribution transformers of 6600/11000Y volt class. These, at our suggestion, have been given a triple rating similar to that of the 2200 volt class, with ratios and taps suitable for banking with transformers previously used in this section and sufficient to allow for the considerable drops required in our rural lines of this voltage with their seasonal loads. The details of the standardization appears in Mr. Lisberger's report.

Distribution Fuses, Switches

A subject of vital interest to the small as well as to the large operating companies is the protection of distribution transformers of various voltages against overloads and short circuits, with its attendant train of maintenance costs, interference with service, life and fire risks, single phasing and consequent motor damage, and high first cost of equipment to avoid these difficulties. This subject has been handled in Mr. Cunningham's paper with accompanying comments on the same subject by several other distribution engineers.

Prime Movers

In the matter of prime movers, this Section is interested in steam turbine operation chiefly as a standby feature, a paper on which is submitted by Mr. Morgan,—also in water wheels of the impulse and high turbine type, information on the latter of which follows, presented by Mr. Jollyman. The committee attempted to obtain information on the operation of internal combustion engines in central station work, without success.

Porcelain Line Insulators

Insulators have been a vexing problem to us all. The deterioration of porcelain insulators had been studied by a committee of your engineers previous to the formation of the Section, with the co-operation of Professor Ryan of Stanford University, and utilizing the equipment of the high tension laboratory of that institution. This study was limited to the vacation season when the equipment and personnel of the University were available, and it developed several lines along which additional work should be carried out. The engineering committee requested the National Bureau of Standards to undertake an investigation of the ceramic problems involved, and this matter was taken up personally by Mr. Lisberger while East with Doctor Rosa of the Bureau. The following is Mr. Lisberger's report on this situation:

March 26, 1917.

Chairman, Engineering Committee,
"Mr. J. E. Woodbridge,
Pacific Coast Section, N. E. L. A.

"Dear Sir: Confirming request made by yourself, as chairman of the Engineering Committee, of the Pacific Coast Section, N. E. L. A., I have to advise that while in the East I visited Doctor Rosa of the Bureau of Standards, consulting with him regarding the possibility of carrying on an investigation that would lead to the satisfactory design of a suspension insulator unit.

"Dr. Rosa received me most cordially and was very much interested in the work as outlined in your letter to him. He agreed that it was a very important problem as the present product turned out by the manufacturers did not seem suitable for the work to which it was being put. In talking over with him how the work could be finahcially undertaken, he advised that the government had not appropriated the amount of money asked for by the Bureau and that sufficient funds would not be available from the Bureau fund, to properly carry out the work. In discussing the matter further with him he advised that he thought it would take at least $15,000 or $20,000 to make a proper study and that if the industry would donate half the sum required the Bureau would donate the other half to carry on the work; the money to be appropriated by the industry from time to time as the requirements of the situation would dictate.

In keeping with my wire to you, I conferred with Mr. McClelland in New York with no definite results as yet. He stated, however, that he would give the matter some further thought. I advised him that he would probably hear from you as soon as I had returned to make my report: Incidentally, Mr. McClelland is considering coming west at an early date and you might be able to consult with him further personally."

The work undertaken by your engineers at Stanford University last year is being continued by Professor Ryan. Professor Ryan outlines his plan in this respect as follows:

"During the present spring we will study the quality of porcelain of all unmounted units on hand, about 135, by the heat they develop when subjected to sustained radio frequency electric fields; also of units that have failed and, for control, units that have not failed, by impregnating fragments with colored water at 1000 lbs. per square inch, by the study of particles and thin sections with the polarizing microscope and by the heating of fragments mounted in strong electric fields at radio frequency."

Professor Ryan also outlines a study to be made by a graduate student on the hardness, toughness and brittleness of a large amount of suspension insulator porcelain now at the University. Briefly this study will be made as follows:

"1. Hardness through the rebound of a diamond headed rock.

2. Toughness through deformation by impact through a steel ball upon properly mounted specimens.

3. Brittleness as indicated by abrasion:
   a. In rattler.
   b. Steel ball mill."

The manufacturers of suspension insulators have each had several types of interconnecting hardware, most of which have in the past been incapable of direct interconnection between types. The engineering committee appointed Mr. Klauber as a sub-committee of one to recommend standard dimensions of pin and clevis type. Mr. Klauber found that the manufacturers had already co-operated in this manner as shown in his report.

Mr. J. P. Jollyman has made a meritorious recommendation looking toward the standardization of pin type insulators, as per the following letter:

March 26, 1917.

"Mr. J. E. Woodbridge,
Chairman, Engineering Committee,
Pacific Coast Section, N. E. L. A.

"Dear Sir: I suggest that the Engineering Committee investigate the question of adopting standards for pin type insulators.

"The object of this investigation would be:

"1. To gather information from our member companies on the sizes and shapes of insulators now purchased for their several operating voltages.

"2. To select from the types now purchased or available, a minimum number of sizes of the best available shapes which will meet our requirements.

"3. To study the shapes selected and take up with the manufacturers any improvements in design which our experience may suggest.

"Such an investigation should reduce the number of shapes and sizes now purchased for substantially the same service and should enable the manufactures' agents to carry better local stock and quote us somewhat better prices."

The chairman of this committee has appointed Mr. Jollyman a sub-committee of one to carry out the work which he recommends.

Joint Pole Construction

The advisability of joint pole construction on city streets has been generally recognized. The advantages of the same type of construction on rural highways are now becoming evident The paper by Mr. MacDonald outlines clearly the tangible and intangible merits of such construction and gives many valuable hints on the organization and routine required for such work.

Inductive Interference

Since the publication of its preliminary report to the California State Railroad Commission, dated July 7, 1914, embodying recommendations for rules which were adopted by the commission and constitute General Order No. 39, the Joint Committee on Inductive Interference of the State of California has carried out a large amount of additional experimental work and computations and is at present engaged in drafting recommendations for the revision of the rules now in force.

The experimental work has been directed mainly to determine whether or not it is possible to avoid similar experimental work in all the various cases that arise. For example, the induction in the parallels that have been available for experimentation has been computed from the known physical constants of the circuits with no reference to the results derived experimentally, and has been compared with such experimental results to determine whether the amount of induction can be computed with reasonable certainty without tests. The results of this comparison show that the relative amount of induction from untransposed parallels of different lengths, separations, configurations, balance, wave shape, etc., can be computed from the dimensions of the circuits without experimental tests with an accuracy comparable with that of the assumptions which usually have to be made as to the amounts of load, balance, wave shape, etc. Such computations have been made for all of the several kinds of induction, electric and magnetic, due to either balanced or residual voltages or currents, over the complete practical range of separation and power circuit configurations, including a large number of cases of twin circuits. This involved an enormous amount of work, the results of which appear in more than 3000 curves on 212 curve sheets.

A large amount of work has been done on the effect of extraneous currents on telephone conversation at the request of the committee by the American Telephone & Telegraph Company, resulting in the design of a new telephone transposition system especially adapted to power line exposures.

Based on the computations above outlined, certain configurations of power lines, both single and double circuit, and certain interconnections of twin circuit lines have been found to be preferable. It appears desirable to require transpositions for the purpose of balancing the capacitance of lines to ground and some other precautionary measures are recommended on all future construction, with certain exceptions, instead of only one lines involved in parallels. This is for the reason that such lines may later become involved in parallels, at which time it is much more difficult and expensive to install transpositions or make other alterations than when the line is under construction.

On account of the demand for a specific definition of what constitutes a parallel with a telephone or telegraph line, the committee is setting forth the factors to be considered and is presenting such information as is possible on the length of exposure that may require power line transpositions to reduce induction, this information being given for the practical range of separation between lines, power line voltages, various power line configurations, and with assumptions as to wave shape, shielding, telephone line unbalances, effect of other exposures, etc.

The necessity has arisen for a basis of division of costs for avoiding or mitigating interference in cases of parallels proposed or created hereafter. Accordingly the committee is giving consideration to this phase of the problem and expects to present a basis which will be applicable to the general case.

Rules and Regulations for Line Construction in California

The California State Railroad Commission proposes to revise its existing General Order No. 26 covering overhead line construction at crossings, and to modify same to make it constitute a general safety code for overhead lines. This committee has offered its assistance to the engineers of the commission to the extent of constructive criticism of the proposed new general order and in any other way that may be desired by the commission. This offer has been accepted by the engineers of the commission and this committee has appointed a sub-committee, consisting of Messrs. S. J. Lisberger, E. A. Quinn and R. E. Cunningham to carry out this work. It is the hope of the engineering committee that this sub-committee may be made a clearing house in this respect for member companies in California, so that the recommendations of the power interests may not conflict and may be of as great assistance as possible to the commission's engineers.

J. E Woodbridge, chairman; H. A. Barre, J. P. Jollyman, L. M. Klauber, J. A. Koontz, C. O Poole, James M. Shepard, J. C. Scrugham, W. C. Hornberger.

The manufacture of nitrogen products from the air, heralded as a possible utilization of Western water powers, will need an abundance of natural lime deposits. The Pacific Coast states, including Idaho, produced 95,000 short tons of lime in 1916, or 3 per cent more than in 1915. This quantity included 13,000 tons of hydrated lime, produced in California and Washington, a gain of 14 per cent. Increase in total production was made in California and Idaho.

REPORT OF ACCOUNTING COMMITTEE

The committee finds that all member companies in the various states within the boundaries of the Pacific Coast Section are operating under classifications of accounts prescribed by their various state commissions, with the exception of those companies in the state of New Mexico. Public utilities doing business in New Mexico do not come under the regulation or control of the State Corporation Commission, therefore the commission has not adopted any classification of accounts with reference to such companies. Submitted hereunder for comparison are the balance sheet accounts of these classifications, together with those prescribed by the Interstate Commerce Commission and the National Electric Light Association. The Nevada and Arizona classifications are very similar, but with this exception a lack of uniformity exists between the various classifications of accounts, as an inspection thereof will indicate:

Balance Sheet—California

Assets—

Fixed capital installed prior to Jan. 1, 1913.
Fixed capital installed since Dec. 31, 1912.
Total fixed capital.
Cash and Deposits.
A. Cash.
B. Special deposits.
Total cash and deposits.
Notes Receivable.
Accounts Receivable.
A. Accounts with system corporations.
B. Due from consumers and agents.
C. Miscellaneous accounts receivable.
Total accounts receivable.
Interest and Dividends Receivable.
Other Current Assets.
Investments.
A. Securities of other corporations.
B. Advances to system corporations for construction, equipment and betterments.
C. Miscellaneous investments.
Total investments.
Materials and Supplies.
Sinking Funds.
Other Special Funds.
Treasury Securities.
Prepaid Expenses.
A. Prepaid rents.
B. Prepaid taxes.
C. Prepaid insurance.
D. Other prepayments.
Total prepaid expenses.
Unamortized Discount on Securities and Expenses.
A. Stocks.
B. Bonds.
C. Miscellaneous.
Total unamortized discount on securities and expenses.
Other Suspense.
Construction Work in Progress.
Corporate Deficit.
Total Assets.

Liabilities—

Capital stock.
Installments on stock subscription.
Funded debt.
Receivers' certificates.
Advances from system corporations for construction, equipment and betterments.
Notes payable.
Accounts payable.
A. Accounts with system corporations.
B. Audited vouchers and wages unpaid.
C. Consumers' deposits.
D. Miscellaneous accounts payable.
Total accounts payable.
Interest accrued.
Taxes accrued.
Dividends declared.
Service billed in advance.
Reserve for accrued depreciation.
Reserve for amortization of intangible capital.
Unamortized premium on debt.
Casualty and insurance reserves.
Income invested since Dec. 31, 1912—in fixed capital.
Reserves invested in sinking funds.
Other reserves from income or surplus.

Corporate surplus unappropriated.

Total Liabilities.

Balance Sheet—Arizona

Assets—

Property and Plant:
Cost beginning of year.
Construction and equipment current fiscal year.
Cost close of year.
Treasury Securities:
Treasury stock.
Treasury bonds.
Investments:
Stocks and bonds of other companies.
Other investments.
Reserve, Sinking and Special Fund Assets:
Depreciation reserve fund.
Sinking fund.
Amortization reserve fund.
Special funds.
Current Assets:
Cash.
Notes and bills receivable.
Accounts receivable.
Interest and dividends receivable.
Material and supplies.
Miscellaneous current assets.
Prepaid Accounts:
Prepaid insurance.
Prepaid taxes.
Prepaid interest.
Miscellaneous prepaid accounts.
Open accounts.
Deficit.
Total Assets.

Liabilities—

Capital Liabilities:
Capital stock preferred.
Capital stock common.
Funded debt.
Mortgage Liabilities:
Real estate mortgages.
Other mortgages.
Reserve Liabilities:
Depreciation reserve.
Sinking fund reserve.
Amortization reserve.
Special reserve.
Current Liabilities:
Notes and bills payable.
Accounts payable.
Matured interest on funded debt unpaid.
Matured interest on notes and bills payable unpaid.
Dividends unpaid.
Deposits.
Miscellaneous current liabilities.
Accrued Liabilities:
Accrued insurance.
Taxes accrued.
Unmatured interest on funded debt accrued.
Unmatured interest on notes and bills payable accrued.
Dividends accrued.
Miscellaneous liabilities accrued.
Open accounts.
Surplus.
Total Liabilities.

Balance Sheet—Nevada

Assets—

Property and Plant:
Cost beginning of year.
Construction and equipment current fiscal year
Cost close of year.
Treasury Securities:
Treasury stock.
Treasury bonds.
Investments:
Stocks and bonds of other companies.
Other investments.

Liabilities—

Capital Liabilities:
Capital stock preferred.
Capital stock common.
Funded debt.
Mortgage Liabilities:
Real estate mortgages.
Other mortgages.
Sinking Fund Liabilities:
Sinking Fund.
Special fund.

Sinking Fund Assets:
Sinking fund.
Special funds.
Current Assets:
Cash.
Notes and bills receivable.
Accounts receivable.
Interest and dividends receivable.
Material and supplies.
Miscellaneous current assets.
Prepaid Accounts:
Prepaid insurance.
Prepaid taxes.
Prepaid interest.
Miscellaneous prepaid accounts.
Open accounts.
Deficit.

Total Assets.

Current Liabilities:
Notes and bills payable.
Accounts payable.
Matured interest on funded debt unpaid.
Matured interest on notes and bills payable unpaid.
Dividends unpaid.
Deposits.
Miscellaneous current liabilities.
Accrued Liabilities:
Accrued insurance.
Taxes accrued.
Unmatured interest on funded debt accrued.
Unmatured interest on notes and bills payable accrued.
Dividends accrued.
Miscellaneous liabilities accrued.
Open accounts.
Surplus.

Total Liabilities.

Balance Sheet—New Mexico.

Public utilities doing business in New Mexico do not come under the regulation and control of the State Corporation Commission, therefore the commission has not adopted any classification of accounts with reference to such companies.

Balance Sheet—National Electric Light Association

Assets—

PLANT INVESTMENT
Plant investment.
Unfinished plant investment. See Schedule "B"
CURRENT ASSETS
Quick Assets:
Cash.
Notes receivable.
Accounts receivable.
Other quick assets.
Business Assets:
Materials and supplies.
Prepaid accounts.
OTHER ASSETS
Investments.
Reacquired securities.
Sinking funds—Invested.
Sinking funds—Uninvested.
Special deposits.
Treasury securities.
SUSPENSE
Debt discount and expense.
Abandoned property.
Jobbing accounts.
Clearance, equalization and apportionment.
Other suspense.

Liabilities—

CAPITAL STOCK
Preferred stocks.
Common stocks.
DEBT
Funded Debt:
Bonds.
Other funded debt.
Current Liabilities:
Notes payable.
Accounts payable.
Consumers Deposits.
Dividends payable.
Bond interest matured.
Other current liabilities.
Accrued Liabilities:
Taxes accrued.
Interest accrued on funded debt.
Interest accrued on unfunded debt.
Other accrued liabilities.
RESERVES
Permanent and Corporate Reserves:
Premium on capital stock.
Unamortized premium on debt.
Sinking fund reserves.
Other permanent reserves.
Operating Reserves:
Renewal and contingency reserve.
Casualty insurance reserve.
Other temporary operating reserves.
PROFIT AND LOSS
Profit and Loss—See Schedules "C" and "D".

Balance Sheet—Interstate Commerce Commission

Assets—

Investments:
Road and equipment.
Sinking funds:
Total book assets at date. (In short column).
Carriers own issues at date. (In short column).
Other assets at date. (In long column).
Deposits in lieu of mortgaged property sold:
Total book assets at date. (In short column).
Carrier's own issues at date. (In short column).
Other assets at date. (In long solnmn).
Miscellaneous physical property.
Investments in affiliated companies:
(a) Stocks.
(b) Bonds.
(c) Notes.
(d) Advances.
Other Investments:
(a) Stocks.
(b) Bonds.
(c) Notes.
(d) Advances.
(e) Miscellaneous.
Total
Current Assets:
Cash.
Special Deposits:
Total book assets at date. (In short column).
Carrier's own issues at date. (In short column).
Other assets at date. (In long column.)
Loans and notes receivable.
Miscellaneous accounts receivable.
Material and supplies.
Interest dividends, and rents receivable.
Other current assets.

Total
Deferred Assets:
Insurance and other funds:
Total book assets at date. (In short column).
Carrier's own issues at date. (In short column).
Other assets at date. (In long column).
Other deferred assets.
Total
Unadjusted Debits:
Rents and insurance premiums paid in advance.
Discount on capital stock.
Discount on funded debt.
Property abandoned chargeable to operating expenses.
Other unadjusted debits.
Securities issued or assumed—Unpledged. (In short column).
Securities issued or assumed—Unpledged. (In short column).

Total

Liabilities—

Stock:
Capital Stock:
Book liability at date. (In short column).
Held by or for carrier at date. (In short column).
Actually outstanding at date. (In long column).
Stock liability for conversion.
Premium on capital stock
Total
Governmental Grants:
Grants in aid of construction.
Long-Term Debt:
Funded Debt Unmatured:
Book liability at date. (In short column).
Held by or for carrier at date. (In short column).
Actually outstanding at date. (In long column).
Receivers certificates.
Non-negotiable debt to affiliated companies:
(a) Notes.
(b) Open accounts.

Total
Current Liabilities:
Loans and notes payable.
Audited accounts and wages payable.
Miscellaneous accounts payable.
Matured interest, dividends and rents unpaid.
Matured funded debt unpaid.
Accrued interest, dividends, and rents payable.
Other current liabilities.

Total
Deferred Liabilities:
Liability for provident funds.
Other deferred liabilities.
Total
Unadjusted Credits:
Tax liability.
Premium on funded debt.
Insurance and casualty reserves.
Operating reserves.
Accrued depreciation—Road and equipment.
Reserve for amortization of franchises.
Accrued depreciation—Miscellaneous physical property.
Other unadjusted credits.
Total
Corporate Surplus:
Additions to property through surplus.
Funded debt retired through surplus.
Sinking fund reserves.
Miscellaneous fund reserves.
Profit and loss—Balance.
Total

The committee, in the limited time at its disposal, has been unable to make any further comparison of these classifications. We find that few of the accountants of operating companies are familiar with the classification of accounts as prescribed by the National Electric Light Association.

In addition to the lack of uniformity your committee finds these classifications are inconsistent in themselves. For example the California Classification requires the segregation of earnings as follows:

Municipal Street Lighting—Arc,
" " " —Incandescent,
" " " —Miscellaneous,
" Power,
Commercial Lighting—Flat Rate,
" " —Metered,
" Power —Flat Rate,
" " —Metered,
Railway Power,
Other Electric Corporations,

followed by the other earning accounts. Earnings are so reported on the annual report of the commission. In contrast with this in reporting the statistical data, the sales for the year in kw.-hr. are requested to be segregated as follows:

Residence Lighting,
Commercial Lighting,
Municipal Lighting,
All Other Lighting,
Industrial Power,
Agricultural Power,
All Other Power.

Other inconsistencies exist which might be pointed out if time permitted.

The committee also finds that a comparison of reports made by different corporations doing business under the same classification often shows such a wide variance that it is almost impossible to make a just comparison between the various accounts unless some additional information is given showing what has been included. We believe that this condition arises from the different interpretations given by operating accountants to the instructions covering the use of the various accounts. One purpose of an accounting committee is to try to remedy this, and it can be accomplished through the interchange of ideas by the different accountants. There are many differences in the accounting detail practiced by the member companies, particular reference being made to the various methods used in distributing the several clearing accounts, due to different instructions issued covering the accounting detail, which instructions are not specifically laid down in the classification, but are left to the discretion of the operating accountants. Uniformity in this regard can be obtained by the numbers through interchange of ideas.

The foregoing covers, in a general way, the conditions as they now exist, and following are a few suggestions as to what should be done in the future.

Sub-committees should be appointed, similar in every way to those formed by the parent association. The committees of the Pacific Coast Section should at all times, and in every way, co-operate with like committees of the parent body, as in this way only will it be possible to obtain national uniformity, which should be the object of all accounting committees.

The committee on Uniform Classification of Accounts appointed by the National Association is hard at work on a proposed uniform classification. This committee has secured copies of the classifications prescribed by all state commissions, as well as the classifications of the National Electric Light Association and the Interstate Commerce Commission, and is at work preparing therefrom a proposed standard classification. The committee is going into this work in a very thorough and systematic manner. When completed this classification will, no doubt, be as near perfect as it is possible to make it, and its universal adoption should be strongly urged. At least a balance sheet can be made uniform and we recommend that this be done. The accounting committee should keep in close touch with all states not now under control of commissions and when these commissions are given the control of public lighting utilities, request should be made that these commissions adopt at least the standard balance sheet.

The balance sheet is the portion of a report to which investors give the most study and comparison.

The various accounting committees will be a great help to all members of the Section. Member accountants can and should submit to these committees any criticism they may have to offer affecting the classifications under which they are operating. These committees should then in turn make suggestions to the state commissions towards improving the classifications. We believe the commissions will gladly receive any reasonable suggestions and co-operate in rectifying any existing inconsistencies. All member accountants should read the association's bulletin. If one intends to get good from the association, one must put something into it. We advise all accountants to make a study of the various questions asked in the question box pertaining to accounting. We find that the larger the company, the farther away from the detailed accounting operations is the officer in charge of the accounts. Sometimes it is surprising to learn how little the accounting officer knows of the detail work being performed. Answering the questions asked in the bulletin will cause the study of one's own accounting conditions and often point out the need of improvement. In reading the bulletin one notes that nearly all questions and answers are asked and given by the same few men. We cannot too strongly urge member accountants to read and study the bulletin, and from this, if from no other source, will a uniform practice eventually be realized. We also suggest and advise accounting officers to interest the men in the more responsible positions under them, to take the new educational courses in electric utility accounting offered by the accounting section of the National Electric Light Association, as this study will be of great benefit to themselves, as well as to the companies they represent.

We repeat—the crying need is uniformity. There is lots of hard work ahead for the accounting committees to do and the work should go on with enthusiasm and dispatch.

Respectfully submitted,

B. T. Story, chairman; M. B. Fowler, W. E. Houghton, C. E. Mynard, W. J. Driscoll, B. B. Stith, C. E. Twogood, W. E. Shaw, Jr, A. C. Johnson, accounting committee.

FUEL OIL AND STEAM ENGINEERING

(Steam turbine operation on the Pacific Coast occupies a unique position in central station practice. Due to the character of the load and the fluctuating supply of hydroelectric power in the mountains, many fine points in the evolution of steam auxiliary operation have been brought to life during recent years. Here is an article by the superintendent of generation and transmission for the Pacific Light & Power Corporation, in whose system is the well-known Redondo power plant. This paper has been prepared for consideration at the Pacific Coast Section Convention of N.E.L.A. at Riverside.—The Editor.)

OPERATION OF A STEAM TURBINE STATION

BY DON D. MORGAN

Plant Equipment

The Redondo plant of the Pacific Light & Power Corporation consists of five prime movers, two 15,000 k.v.a. General Electric vertical turbines, and three 5000 k.v.a. McIntosh & Seymour double horizontal-vertical cross compound reciprocating units, four 75 kw. reciprocating and one 100 kw. turbine driven exciter units, three 30,000 gal. 30 in. centrifugal circulating pumps, each driven by a 450 h.p. tandem compound engine. There are 18 Babcock & Wilcox and 18 Stirling water tube boilers, of 604 b.h.p each, operating at 175 lb. gauge pressure and 125 deg. F. superheat, making a total of 21744 b.h.p. at rating. The boilers are capable of developing 100 per cent over rating. There are five 6 in. tandem compound duplex boiler feed water pumps, one 1000 gal. and one 1600 gal. centtrifugal boiler feed pumps, the centrifugal pumps being driven by a 250 and 375 h.p. steam turbine respectively.

Normal Operation

When the plant is in normal operation:

The average daily output is 600,000 kw.-hr.

The average daily fuel oil consumption is 2600 bbls.

The average daily peak load is 40,000 kw.

The average daily efficiency is 230 kw.hr. per barrel of oil.

The average number of boilers fired for a peak of 40,000 is 34; two boilers are usually out of service for cleaning, repairing and so forth.

When plant is in full operation about 75,000 gals. per min. of circulating water is required for condensing purposes to maintain a vacuum of 28.75 in. on turbines and 27.5 in. on reciprocating engines. Ocean water is used for condensing and is obtained by means of three 54 in. pipe lines running 800 ft. out over the sea on a concrete pier, each pipe line having seven 26 in. drop pipes submerged in from 14 to 16 ft. of water. The water is siphoned into a settling chamber for the purpose of eliminating the sand and sea weed, of which there is more or less floating at all times; from here the circulating pumps lift the water from 8 to 15 ft. according to the height of the tide and it is put through the condensers under a head of 12 ft. at a distance of 400 ft. from the pumps.

Standby Operation

Under standby conditions the plant is kept in readiness to pick up 5000 to 6000 kw. as soon as a turbine can be brought up to speed, the average time required being about five minutes, although they have been brought up in three and one-half minutes, which can be done with safety if turbine has not been out of operation too long. The operating force is from 40 to 43 men.

Step bearing and guide bearing pumps are kept in motion at all times, also one of the engine-driven exciters. This is done to keep the apparatus warm and free from water and to facilitate rapid starting.

The engine room force under standby conditions is the same as under operating conditions, with the exception of the reciprocating engine oilers. The boiler room operating force is about one-third what it is under operating conditions, boiler cleaners, repair men and so forth becoming firemen and water tenders when the plant is started up.

In the event of trouble on the system of sufficient magnitude to drop the speed and voltage to zero or 10% below normal and it does not immediately come up, the operator on duty blows a signal whistle which is heard all over the plant. This signal starts the first turbine and auxiliaries and all men on duty at the time drop whatever they may be doing and take their operating stations in the engine room and boiler room. Fires are immediately started under the 18 boilers that are up to pressure and as soon as the electrical operator on duty is advised by the despatcher regarding the requirements, all the other boilers are fired, if needed, except those that may be out for cleaning or repairs, as a rule not over three. If it is known that the entire plant will be required to operate for any length of time, the steam siren is blown, calling all men off duty to the plant.

Boilers Up to Pressure

Under standby conditions, 18 boilers are kept up to pressure and ready to fire at all times. This is done as follows: It requires nearly full capacity of one boiler at all times to supply steam for the auxiliaries and take care of the losses in steam piping due to condensation. The 18 boilers that are kept up to pressure are fired one at a time, about 2 hours each, in regular sequence. By this means the last few boilers fired are hot enough to generate steam as soon as the fires are lighted and the others will commence to deliver steam in proportion to the time since they were last fired. All dampers and doors on all boilers, except the one being fired and those out for repairs, are kept tightly closed. The fuel oil is kept at a temperature of 180 deg. and circulated by the pumps through the heaters, burner lines and back through the burning tank. Under these conditions and when the plant is strictly on standby the fuel requirements are about 110 barrels of oil per day.

It is possible with this arrangement to pick up about 5000 kw. in five minutes (or by time turbine is

cut in) and 1000 kw. each minute up to 15,000 kw., or 15,000 kw. in 15 minutes, and both turbines on up to full load, 30,000 kw. in 25 minutes.

Boilers at Atmospheric Pressure

Fifteen to seventeen of the 18 Stirling boilers (depending on the number out for repairs or cleaning), are kept full of water from 150 deg. to 175 deg. F. The water is kept at this temperature by using the overflow from the Cochrane feed water heaters. Under standby conditions the exhaust steam from the plant auxiliaries is more than sufficient to heat the small amount of feed water required.

The overflow from the heaters to the hot well is picked up and circulated through the boilers and returned to the hot well where it is pumped into the heaters by means of a float-regulated make-up pump.

Temperature Turbine Stages 1	2	3	4	Cond Base	Vacuum Cond	Barometer	By-Pass Valve Open	Electrical Measurements Cycles	Ind kw	Field
272	200	160	157	102	26.8	29.88	5/16 in.	50	0	90
258	188	158	154	104	26.6	29.86	5/16 in.	49.5	—700	200
262	200	164	166	106	26.3	29.86	5/16 in.	50.5	—200	150
280	152	113	100	93	28.6	30.0	3/16 in.	50.0	0	210
258	204	155	146	100	27.0	29.96	3/16 in.	50.0	—200	150
260	197	158	169	102	27.2	29.96	3/16 in.	50.0	—1000	195
271	158	131	128	130	28.1	29.6	3/4 in.	No readings taken.		
276	159	126	124	126	28.2	29.92	3/4 in.	No readings taken.		
272	157	128	124	128	28.2	29.96	3/4 in.	No readings taken.		

These boilers are not under pressure and keeping them at this temperature not only makes it possible to fire them up and have them generating in less than 30 minutes, but helps to keep down corrosion.

The hot water circulating system for these boilers is entirely independent of the feed water system. It consists of a low pressure reciprocating pump run at the proper speed to keep the required water level in the boilers, and connects to the boilers by means of 4 in. headers and 1½ in. pipe connections to the mud drums. The gravity return is from the middle drum through a similar piping arrangement. Check valves are provided at each mud drum connection and the gravity return from the boilers is taken care of by manually operated valves controlled from the boiler room floor. This arrangement, after about one year's try out, has proven entirely satisfactory and we believe is nearly, if not quite fool proof. This arrangement saves about 12 barrels of oil per day over the previous method of occasionally firing up these boilers, which required about 3 barrels of oil to the boiler.

A load of 44,000 kw. has been picked up in 46 minutes after emergency signal had been blown with 34 boilers in service.

Engine Room

In the engine room it is found necessary to warm up the reciprocating engines twice each week. They are brought up to speed but not cut in. The engines on the circulating pumps are brought up to speed every day, due to the 400 ft. of steam line supplying them. Due to load conditions it is necessary to float one of the turbines from two to two and one-half hours per day. The two turbines are alternated in this service. The turbine is brought up to speed and synchronized in the usual way but given only sufficient steam to maintain minimum temperature of turbine blading, the wattmeters on the generator loads reading approximately zero. This is accomplished by adjusting the governor so that it will not operate unless the speed drops about 5 per cent, and admitting steam to the turbine by means of a hand regulated valve at the first nozzle valve. As the purpose of floating the turbine on the line is to make use of the generator as a condenser, tests were made to determine the minimum amount of steam required to prevent excessive heating of the blading.

Testing Turbine Generator as Condenser

These tests were made by bringing the turbine up to speed and synchronizing in the usual way with the vacuum pump in normal operation. Temperatures were taken by means of Fahrenheit thermometers in the first, second, third and fourth stages and the condenser base. Electrical readings were also taken at the same time. Below is given a few of the readings which are typical of the various conditions:

The readings obtained were sometimes very inconsistent. Observations were made covering several days on the various by-pass openings. At the time these tests were made the 3/16 in. by-pass opening was decided upon as the minimum opening for this condition of operation, the temperatures going up if a smaller opening was used.

"By-Pass" Valve

The "by-pass" valve, so called, is an alteration in the first 3½ in. nozzle valve supplied with the turbine by the manufacturer, in which the regular stem is removed and a threaded valve stem with hand wheel is installed in its place. This arrangement makes the valve non-operative by the turbine governor. Each turbine is overspeeded once a week to insure the satisfactory operation of the overspeed tripping device.

Condenser Water

Water for the condenser is supplied by an 8 in. centrifugal pump delivering water through the regular salt water line to the condenser. A butterfly valve is installed in the 36 in. discharge line from the condenser, which is kept closed at all times while turbine is acting as an electrical condenser. The valve is manually operated by a worm gear. A 10 in. outlet is provided to remove the hot water from the top of the condenser. Fresh water is kept in the reciprocating engine condensers to prevent tube packing from drying out and to prevent corrosion.

Fuel Oil

Under present operating conditions an average of about 140 bbl. of fuel oil is required for daily operation. This takes care of the warming up of apparatus and the operation of the turbine driven generator used as a condenser from two to three hours per day. The use of the generator as a condenser requires about four barrels of additional oil per hour for the turbine and its auxiliaries.

Dry Out of 18,000 Volt Generators

The 5000 kw. 18,000 volt generators direct connected to the reciprocating engines are kept on an electrical dryout, due to the atmospheric conditions so close to the ocean. This is accomplished by a.c. current from the station auxiliary transformers. Each generator is supplied with about 200 amps. at 440 volts, single-phase, to the 18,000 volt generator leads, through disconnecting switches so arranged that it is impossible to connect generator to the high tension busses until the dryout connection is opened.

The armature windings are connected "star" with the neutral grounded and while on dry out, the 400 volt current is applied by connecting two generator terminals to one side of the 440 volt circuit and one to the other. While this arrangement does not give an equal amount of current in each phase winding it was found to be suitable for the voltage available and provided sufficient heat to keep the windings dry without an excess of current in any one winding.

The temperature of the windings varies according to atmospheric conditions and ranges between 35 deg. and 46 deg. C. About 500 kw.-hr. per day per generator is required for this purpose. As there are three of the 18,000 volt generators on this dry out, the load on each phase of the station auxiliary transformers is fairly well balanced.

Standby Maintenance

In general, considerable trouble is experienced, due to leaky valves and flanges, and more or less trouble on account of corrosion. Trouble with the superheaters has been eliminated to a considerable extent by providing drips from them to the regular drip system. All main and auxiliary steam lines are taken care of in a like manner and the drips are piped to a centrally located separator and returned to the boiler feed-water line. The principal maintenace is taking care of leaky piping and valves due to temperature variations and corrosion.

Emergency operation under standby conditions is very inefficient, due to lack of experience of the men who are called in to do the work for only short periods at infrequent intervals.

Such changes as have been made from time to time in the steam department, on account of the standby conditions, have been brought about by degrees due to the small operating force, and mostly have been devised and installed by a very competent and conscientious chief engineer to whom the writer of this paper is considerably indebted for the information contained therein.

PROGRESS ON PROTECTION OF OIL FIELDS

The first annual report, covering the work of the California State Mining Bureau in protecting California oil fields from infiltrating water, has just been published and is ready for distribution. The public is interested in the protection of the oil fields owing to the widespread use and importance of petroleum; and the operators who have their money invested in the oil fields are directly concerned in seeing their property protected from damage caused by careless and inefficient drilling methods, which have been little short of universal. The distribution of the report will be helpful at the present time, as some amendments to the law are now before the legislature, and a thorough public knowledge of the facts is necessary.

HIGH COSTS AFFECT ELECTRICAL INDUSTRY IN CHINA

The abnormal situation in the Japanese coal market arising from the greatly increased demand there for fuel for industrial plants, and the diversion of mining labor into better-paid channels, is now reflected in China, largely as a result of the scarcity of shipping. The central and southern parts of the country are particularly affected. In Shanghai prices are about 30 per cent higher that last year, and it is possible that they have not yet reached a maximum.

The municipal electricity department, which is a a very large purchaser, has been paying so much more than usual that it is becoming a question whether it can continue the low rates for current for industrial purposes that have been an important factor in the recent growth of manufacturing plants in Shanghai.

ELECTRICAL CONDUIT IN NEW ZEALAND

Jobbers and importers in New Zealand have experienced difficulties recently in obtaining enough electrical conduit to meet their needs from the usual sources in England. They are interested in American sources of supply and have asked about the possibility of manufacturers in the United States, making conduits in accordance with the local standards, with the object of meeting the demands of this market.

Brazed or welded heavy-gauge conduit is commonly used, made up with screwed, or as we term it, threaded joints. The North Island has a wider use for the brazed joint, while in the South Island the welded is more popular. There is also some use of the open joint with slip or grip fittings.

CAUSE OF DELAY IN N. E. L. A. PUBLICATION

April 2, 1917.

Sir:

In regard to the Meterman's Handbook, we would say in explanation of the delay, that we are becoming considerably embarrassed on account of the difficulty if not the impossibility of securing the paper with which to print this book. It is a special high grade of light weight paper made by relatively few mills; and the three mills to which we applied first for paper, absolutely declined to take our order. At this moment, we have succeeded in closing with a fourth mill and are hopeful that we may have the paper delivered to us in a couple of weeks, but as to this we have no guarantee.

We should also like to state that at last we have just received the new edition of the Overhead Line Construction Handbook, which will be issued immediately. We are in the class with all other purchasers of apparatus and material in these days, subject to many months of delay which seems unavoidable.

We are now only waiting for the covers of the Salesman's Handbook of which we are promised delivery in about 3 weeks and copies will be mailed shortly after.

T. C. MARTIN, Secretary.

SPARKS—Current Facts, Figures and Fancy

(Notations on recent evolution in Eastern central station practice are always interesting to engineers of the West. The progress of legislation on water power development, too, is always followed with keenest attention. These matters, together with other jottings that will give you ideas and inspiration for future effort are discussed briefly in the following lines.—The Editor.)

The average passenger train earns, for carrying passengers, mail, express and parcel post, about one dollar forty cents per mile.

* * *

Forty per cent of the United States has now been mapped by the United States Geological Survey with topographic sheets. Over fifteen million dollars have been spent on this work, covering a period of nearly forty years.

* * *

A good proverb to bear in mind at all times says: "Whoever wishes to study with success must exercise himself in these three things: In getting clear views of a subject; in fixing in his memory what he has understood; and in producing something from his own resources."

* * *

In the General Grant National Park in central California, there are more than twelve thousand sequoia trees exceeding ten feet in diameter, seven of the largest range from twenty-seven to thirty-six and one-half feet in diameter, and in height from two hundred fifty-five to two hundred ninety-two feet.

* * *

Orville Wright, the noted aeroplane inventor, sees ahead a new transportation problem to be solved in the evolution of the aeroplane as a use in transporting gold. Especially does he see by this means a new and hitherto unrivaled development for Alaska in her inaccessible, but rich mineral districts.

* * *

That mine timbers of white spruce, Sitka spruce, white birch, and western hemlock grown on the Chugach National Forest, Alaska, are fully as good as Douglas fir from the Rocky Mountain region and are superior to other Rocky Mountain species for use as mine timbers has been demonstrated by the Forest Products Laboratory at Madison, Wis.

* * *

According to the recent annual report of the American Telephone & Telegraph Company there are now nearly twenty million miles of wire in operation of telephones. This is almost sufficient in length to connect us up to Mars at the proper season of the year in order to enquire about the possible use of electrical pumps on the famous canals said to exist there.

* * *

In only one case out of nearly ninety thousand operations have the automatic electric block signals of the Southern Pacific, on the average, failed to give proper indication to the engineer in the cab. By failure is not that the engineer was not warned of danger, but rather that he was held back when the track was clear. Such are the wonders of modern electric genius.

Frank Trumbull, chairman of the railway executives advisory committee, states that if you should write a letter to any American railroad official, his company will have to haul a ton of freight—two thousand pounds of average freight—coal, ore, silks, ostrich feathers and everything—for more than two and one-half miles to get enough money to buy a postage stamp to send you an answer.

* * *

As an example of the lack of progress along electro-chemical lines in America, it is pointed out that open-hearth furnaces are as yet the prevailing type in this country, yet by the use of the more modern closed hearth type, as much fixed nitrogen could be saved as is now needed for all the ammunition for all the armies now at war, and enough coal tar to meet the needs of the whole world in the making of dye-stuffs and medical substances.

* * *

The general dam bill, one of the water-power measures before Congress, was killed for the session by a hopeless disagreement of conferees, who were unable to reconcile differences between the House of Representatives and the Senate provisions. It is hoped that hydroelectric development will come into its own in the near future and cease to be hampered by dilatory tactics at Washington.

* * *

Indicative of Eastern evolution in central station practice, the recent changes in policy of the Edison Electric Illuminating Company of Brooklyn are interesting. Discontinuance of the free supply and renewal of incandescent lamps has been made; carbon or gem lamps are no longer kept in stock; Mazda lamps are used exclusively; and on original installations of lamps for any customer, the company will permit the customer, if he desires, to pay in monthly installments along with the bills for current.

* * *

In co-operation with the Department of Psychology of the University of Wisconsin, the Forest Service has made a study to determine the effect of color of paper and of glare upon eye fatigue. Some original and interesting methods of testing eye fatigue were developed. These studies showed that practically no difference in eye fatigue was produced by reading from newsprint paper manufactured from tamarack as compared with that from spruce. From the standpoint of ease of reading there is no valid objection to newsprint paper made from woods such as tamarack which produce darker colored papers.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., required by the Act of Congress of August 24, 1912, of "Journal of Electricity," published semi-monthly at San Francisco, California, for April 1, 1917.

State of California,
County of San Francisco—ss.

Before me, a notary in and for the state and county aforesaid, personally appeared E. B. Strong, who, having been duly sworn according to law, deposes and says that he is the president and business manager of the "Journal of Electricity," and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Names of	Post Office Address.
Publisher, Technical Publishing Company	No. 6 Crossley Bldg., San Francisco
Editor, Robert Sibley	No. 6 Crossley Bldg., San Francisco
Managing Editor, A. H. Halloran	No. 6 Crossley Bldg., San Francisco
President and Business Manager, E. B. Strong	No. 6 Crossley Bldg., San Francisco

2. That the owners are: (Give names and addresses of individual owners, or if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)

E. B. Strong	San Rafael, Cal.
R. J. Davis	Berkeley, Cal.
A. H. Halloran	No. 6 Crossley Bldg., San Francisco
C. L. Cory	Nevada Bank Bldg., San Francisco
Robt. Sibley	Berkeley, Cal.
Mrs. L. B. Storey	Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

E. B. STRONG, President.

Sworn to and subscribed before me this 26th day of March, 1917.

(Seal) CHARLES EDELMAN,
(My commission expires April 7, 1917.)

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OUR PRESENT DUTY

As engineers of the West we salute the grand old flag as a unit, bearing fully in mind the thought that it is of utmost importance throughout the present trying scene through which the nation is passing that there be an avoidance of paralysis of effort in every phase of business activity. In the mobilization of national industrial resources the part that men of the electrical industry will play can not be overestimated. The great hydroelectric resources of the West are capable of rendering untold service to the nation. Let us then proceed quietly about our daily tasks with the calm assurance that all that can possibly be done is now being properly cared for and let each stand ready to offer to the nation, immediately upon the summons, the best within him for the task required of him no matter what that demand may be.

Mobilizing the Electrical Industry

The clarion call to arms is being answered by electrical men everywhere. In the national guard, in the officers' reserve corps, and in volunteer rifle clubs men of the electrical industry are ready to serve their nation as they have been heretofore serving the electrical needs of its population. Three hundred employes of one Western central station are drilling daily on company time.

So spontaneous has been the response that the problem of raising an army for the front is already dwarfed by the necessity for effectively organizing those who are needed at home. "For every man in the field there must be one at home." The mobilization of troops is really secondary to the mobilization of the country's resources to care for them.

The farmer must till the ground and the mechanic work in the factory. This involves the government's eventually taking over all industries and making governmental necessities paramount to existing contracts with private parties. The supply of electric energy is a public necessity which will undoubtedly come under military control as serious eventualities develop.

This question will be given weighty consideration at the Riverside convention of the Pacific Coast N. E. L. A. Section. Two of its members are on the California council for defense, the electrical men of Arizona and New Mexico are deeply interested in the border situation and Nevada's representatives are fully alive to the situation. Discussion and action at the convention will be followed with keenest interest.

A Constructive Public Policy

When Alexander, the Great, sighed his soul for more worlds to conquer, it is not unbelievable to imagine that he emphatically was saying "This is the last great war." When Hannibal, in the dead of winter, led his all-conquering Carthagenian troops down from the Alps, he, too, undoubtedly whispered, "This is the last great war." When Napoleon swept the map of Europe from its former recognizable boundaries possibly in his quieter moments he may have been heard to mutter, "This is the last great war."

And so when this present generation shall witness dynasty after dynasty pass away and the conflicting world forces readjusted so that a more harmonious development of human life becomes possible, we, too, may be tempted to say in our hearts "This is the last great war." But it is well to remember through it all that the evolution of life is infinite. New problems, new ideals—each the champion of its day—must unfold as the years roll on. Hence new struggles, new combats—devoid of bloodshed or the taking of life we hope—must of necessity arise throughout all ages. Such are the demands of life and its unfoldment.

Let us then, as builders, build wisely and on such broad lines as to minimize friction and promote cooperation. A recent decision of the United States Supreme Court is far reaching in its effect upon the future harmonious development of hydroelectric power throughout the West. Briefly, the Supreme Court has ruled that until further legislation is enacted hydroelectric power companies are denied fee title to rights-of-way over government land and are restricted in the use of such rights-of-way as may be granted so that these become mere leases or easements issued by the Department of the Interior or Agriculture.

Such a state of affairs is indeed most deplorable. The West is urgently in need of continued water power development. The high cost of fuel makes such development a necessary adjunct for practically every phase of civic, domestic and industrial growth.

The time for bickerings and petty quibbles has long since passed away. This country is now united heart and soul for unified and harmonious action. Reasonable legislation should be passed at the earliest date possible to stabilize this necessary unit in our present mobilization of national resources.

The Last Word from the Canal

The great slide at the Culebra cut in the Panama Canal which occurred during the Panama-Pacific International Exposition at San Francisco, caused much gossip and many forebodings throughout the civilized world as to the possible future usefulness of this great waterway. Especially was the comment in certain of the foreign press of an unusually pessimistic tone.

The gathering of engineers at the San Francisco Engineers' Club recently in honor of the return of three noted American scientists and engineers from a tour of the Orient was more than gratified to hear a most encouraging word from one member of the party who has recently served upon a commission of noted geologists, physicists and engineers appointed by the President to investigate the possibility of a future occurrence of the incident.

It was stated that the report of this commission, composed of the most eminent specialists the world has produced, is unanimous in its verdict that the canal will in the future remain open, that serious slides are a thing of the past, and that such slides as may occur at rare intervals will be only a matter of a day or a week at the most for their proper disposal.

Traffic reports show that shipping has practically resumed its normal rating and that engineers and commercial bodies of the Pacific area can again rejoice in anticipating that this unprecedented engineering feat will bring about, as the years roll by, the much-heralded fruits of friendly and economic commercial intercourse with all the great shipping channels of the world.

Scandalous Neglect of Vehicle Load

That the electric passenger car and especially the electric truck offer untold opportunities for increased profitable power consumption in central stations of the West is the conviction to which close watchers of evolution in vehicle design are fast coming.

The eyes of the public have been so totally blinded by the fascinating and overpowering publicity campaign of the gas operated car that central station managers have evidently overlooked almost with scandalous neglect the possible fruitful results that await the careful nurturing of this most desirable off-peak load.

A close similarity in the almost total abandonment of this nurturing on the part of the central station may be drawn to the happenings in the days of Sir Isaac Newton. This great scientist had so dazzled the scientific and business world with his famous logic and inventions that the very expression of an opinion on his part had for reaching consequences. He stated that refracting telescopes could never be made to correct for the dispersion of light rays of different color or wave length, consequently the entire world abandoned for fifty years the use of refractive telescopes and adopted the cumbersome reflectors thus setting back the development of the wonders of astronomy for a half century.

And so in case of the gas-operated car, the argument of superior speed and distance has been used so effectively against the electric vehicle by the gigantic publicity of the manufacturers of gas-operated cars that the electric truck has had a severe struggle for existence and the electric passenger vehicle has almost passed out from use in the West.

A new awakening is now upon us. The splendid highways throughout the West with their easy access to electric service on all sides augur well for future activity of the electric vehicle in the country. And in the city the unquestioned superiority of the electric vehicle in practically every count offer for the progressive power sales manager an unusual opportunity for creating a gigantic off-peak load that will tend much, as years roll on to stabilize the fluctuating load factors now experienced in hydroelectric practice.

PERSONALS

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, has added another honor to his long list of valuable services to the public. Mr. Britton has been appointed by the Governor of California as a member of the California State Defense Board along with a distinguished array of the greatest business and executive talent that California has produced. As the hydroelectric activities of the state will undoubtedly have a far reaching influence in every phase of national defense his appointment is indeed gratifying to all members of the electrical industry.

Chas. H. Spinks, in charge of construction for the Hetch Hetchy Railroad, is a recent San Francisco visitor.

B. G. McDougall, manager of the Manhattan Electric Supply Company, is at Portland, Ore., from New York City.

Dr. Thomas Addison, Pacific Coast manager of the General Electric Company, is spending several months in the East.

Hal Lauritzen, Holophane salesman of the Pacific States Electric Company, has returned to San Francisco from an Eastern trip.

H. B. Squires of the H. B. Squires Company of San Francisco, is on a business trip throughout the East to be absent about thirty days.

Tracy E. Bibbins, president of the Pacific States Electric Company, after an absence of several weeks, is again in his San Francisco office.

C. E. Groesbeck, vice-president and general manager of the Utah Power & Light Company, has returned to Salt Lake City from Los Angeles.

W. S. Berry, sales manager of the Western Electric Company, has returned to San Francisco from a seven weeks' sojourn in the Hawaiian Islands.

M. L. Joslyn, of the Baker-Joslyn Company, is visiting the San Francisco office on his return trip East after a delightful visit to the Hawaiian Islands.

Carl Heise, Pacific Coast manager for the Westinghouse Electric & Manufacturing Company, has left San Francisco for a three weeks' sojourn in the Hawaiian Islands.

E. D. Pike, of the Wagner Electric Manufacturing Company, San Francisco, has left for the East to attend the Sales Managers' Convention of his company at St. Louis.

J. M. Barry has resigned as chief of the San Francisco Department of Electricity to become engineer of distribution for the Great Western Power Company at San Francisco. **Arthur Kempston** succeeds Mr. Barry as chief.

L. A. Wright has been appointed local manager of the San Diego Consolidated Gas & Electric Company at Escondido, Cal., to have charge of the gas and electric utilities in that district recently taken over by the company for operation.

Edward Whaley has recently been appointed general agent for the Northern California Power Company, Cons., in addition to his duties as secretary. He will actively direct the commercial and public policy of the organization, maintaining his offices at San Francisco.

Henry Bostwick, formerly secretary to the president of the Pacific Gas & Electric Company, has been promoted to the position of assistant to the first vice-president. Mr. Bostwick, who is well known to the electrical fraternity throughout the West, is the recipient of congratulations from all quarters.

E. B. Strong, Jr., treasurer of the Technical Publishing Company, publishers of the Journal of Electricity, is now with Company D of the Fifth Regiment, National Guard of California, and is just in receipt of a commission from President Wilson promoting him to the rank of second lieutenant.

George C. Mason of the Hurley-Mason Company, has been appointed by the civic committee of the Realty Board in Portland to make a thorough investigation of the plans for the proposed municipal lighting plant. Mr. Mason estimates that the work of checking will take from two to three weeks.

Edward West, formerly efficiency engineer for the Portland Railway, Light & Power Company, but now chief engineer at Denver, Colo., for the Denver Tramway Company, is back in Portland for a few days, as a result of the serious illness of his father, H. G. West, employed by the Portland Railway, Light & Power Company.

John A. Brashear, educator and manufacturer of astronomical and physical instruments; **Ambrose Swasey,** president of The Warner & Swasey Company of Cleveland, Ohio, and **John R. Freeman,** the well-known hydraulic engineer, are recent San Francisco visitors who have just returned from a four months' tour of the Orient.

Leonard Lundgren, district engineer of the United States Forest Service in Portland, has been designated as ordnance officer for the coast defense command of Oregon. This position entails accountability for all ordnance property, armament and equipment of the Oregon coast defense, and the inspection of all such property at least once each month.

C. I. Kephart and **Kenneth V. Laird,** formerly of California, are now at Anaconda, Montana. Mr. Kephart is valuation engineer in charge of a party for the Interstate Commerce Commission, and has been handling the valuation of the Butte, Anaconda & Pacific Railroad, the pioneer 2400 volt d.c. electrified road in the United States. Mr. Laird is operating the Cottrell flue gas treater for the Anaconda Mining Company at the Washoe smelter.

F. O. Broili, industrial engineer of the Northwestern Electric Company, Portland, Oregon, was the guest of honor at a luncheon held at noon, March 30th, at the Hazelwood restaurant. The occasion of the honorary luncheon was the fact that Mr. Broili is leaving the employ of the Northwestern Electric Company to accept the position of president and engineer of the Nevada Machinery & Electric Company, Reno, Nevada, as announced in the issue of the Journal for April 1. The employes of the Northwestern Electric Company, including the engineering, operating, commercial, auditing and purchasing departments, made up the guests invited.

Wiliam B. Burbeck, engineering works, sales department, Pacific Gas & Electric Company, San Francisco; **Walter John Delehanty,** construction foreman, Pacific Coast District, General Electric Company, San Francisco; **Robert Sindorf Ferguson,** instructor in mathematics and electrical laboratory, Throop College of Technology, Pasadena; **Otis Gibson,** civil engineer, Keystone Dredging Company, San Francisco; **Jesse Russell Himmelsbach,** student, University of Washington, Seattle; **Joseph Earl Kettlewell,** power plant foreman, Yukon Gold Company, Iditarod, Alaska; **Edgar George List,** maintenance engineer, Utah Power & Light Company, Olmsted, via Provo, Utah; **Charles Alexander Mendenhall,** telegraph and telephone engineer, Interstate Commerce Commission, San Francisco; **Clyde Pattee,** plant department, Oregon-Washington Telephone Company, Hood River, Ore.; **Alexis Joseph Reed,** engineer, equipment department, Pacific Telephone & Telegraph Company, San Francisco, have been elected associates of the American Institute of Electrical Engineers.

MEETING NOTICES FOR ELECTRICAL MEN

(War and military preparedness occupy in a marked degree the discussions in practically all the gatherings of the past two-week period. Especially has discussion leading toward training men for the Engineers' Reserve Officers Corps been most marked. In spite of this war talk, however, effective planning for conventions and electrical gatherings of the year still grow apace, for it is generally realized that mobilization of industrial strength of the nation can be vastly aided by such gatherings and discussions and as a consequence that these gatherings should be held come what will, what may. —The Editor.)

San Francisco Engineers' Club

The luncheon talk for the San Francisco Engineers' Club on March 29, 1917 was given over to a consideration of co-operative organization and how it is applied. The speaker of the day, A. B. C. Dohrmann, was introduced by N. A. Bowers. Forceful incidents were recounted by the speaker in the course of his address as to how co-operation in certain of the mercantile industries of San Francisco and vicinity has worked wonders in putting that particular business an a firm footing. The speaker concluded by saying that true co-operation assisted all in a particular industry to find the true aim desired, then how to go about attaining and finally bringing about the ultimate aim in view.

A luncheon on April 3 was given at the club rooms in honor of Dr. John A. Brashear, Ambrose Swasey and John R. Freeman who have recently completed a four months' tour of the Orient. Geo. W. Dickie, the well-known consulting naval architect, acted as chairman. The luncheon was the most widely attended gathering of the year and the interesting impromptu remarks of the three guests were listened to with unusual attention.

Los Angeles Jovian Electric League

March 28th was Military Day at the regular Wednesday luncheon and several inspiring and impressive addresses were given by prominent army officers. Measures of preparation for national defense were also discussed. Upon the motion of R. H. Ballard, it was unanimously decided that all members should take up with their respective companies the matter of giving their approval to all enlisting employes, and of keeping their positions open until their return. Dr. Charles W. Decker, major of field medical corps, acted as chairman of the day, and after a brief address he introduced Charles F. Hutchins, Colonel Seventh Infantry, C. N. G., whose subject was "Military Possibilities in Los Angeles." He was followed by W. L. Moreland, manager of the Moreland Truck Company, who spoke on "Highways and Motor Vehicles in Pacific Coast Defenses," and Mr. H. B. Light, Colonel of Artillery Reserve, whose topic was "Fort MacArthur."

The meeting for April 4 was under the chairmanship of Harry G. Holabird, manager of the Holabird Electric Company. The speaker Thomas Lee, Woolwine, district attorney for the county of Los Angeles, spoke interestingly and instructively of the work in the district attorney's office.

BUILDERS OF THE WEST—III

R. H. BALLARD

The younger generation is fast making itself felt in engineering of the West. From all sections of the West are emanating ideas in constructive engineering methods that are daily serving as patterns for the central station activity of a nation. To R. H. Ballard, assistant general manager of the Southern California Edison Company and president of the Pacific Coast Section of the National Electric Light Association, this issue of the Journal is affectionately dedicated in recognition of his splendid ideals in comradery not only instilled among the men of his company, but among all with whom he comes in contact.

Joint Meeting of Portland Sections of A.I.E.E. and N.E.L.A. With the Oregon Society of Engineers

The bi-weekly luncheon of the joint local sections of A.I.E.E. and N.E.L.A. and the Oregon Society of Engineers was held Wednesday noon, March 28, at the Oregon Hotel, Portland, Oregon.

The luncheon was in charge of the Westinghouse Electric & Manufacturing Company with C. L. Wernicke as chairman of the day.

The speaker of the day was A. G. Labbe, vice-president of the Willamette Iron & Steel Works, whose subject was "Some of the Features of the Proposed Anti-Picket Law." The attendance was forty.

The Southwestern Electrical & Gas Association

The thirteenth annual convention of the Southwestern Electrical & Gas Association will be held in the Adolphus Hotel, Dallas, Texas, April 26-28, 1917.

The registration bureau and secretary's desk will be located in the lobby of the Adolphus Hotel, close to the hotel office. As soon as members, visitors or guests arrive or are settled in their hotels, they should at once go to the secretary's desk, register and receive their badges. This will greatly facilitate the work of the convention and will be a convenience to all other members, etc., who may be desirous of knowing of the arrival of their friends and acquaintances.

The morning of the first day of the convention, Thursday, April 26th, will be devoted to the "Opening Session," which includes the "Address of Welcome" and the response to it, the president's address, the election of new members, the appointment of the convention committees and other preliminary business. The street and interurban sessions will be held on the afternoon of that same day and the morning of the next day, Friday. The gas sessions will be held in parallel with those of the street and interurban railway sessions on Thursday and Friday, but these will be held in separate rooms. The electric light and power sessions will be held on the afternoon of the second day of the convention, Friday, and the morning of the third day, Saturday. The general session will be held early in the afternoon of Saturday. At this session will be discussed any matters of interest and value to all the members of the association. The business session will immediately follow the general session. At this session will occur the reports of the treasurer, secretary and all committees and

the nomination and election of the officers and standing committees for the ensuing year.

The papers and addresses have been selected by the several section committees of gas, electric light and power, and street and interurban railways, with special reference to the present needs of the members of their respective sections. It has been deemed best by all three of these committees to devote one of two sessions of each to practical operating subjects and the other session to executive and administrative matters and to matters of public policy.

San Francisco Electrical Development & Jovian League

The program for the luncheon talk of the San Francisco Electrical Development & Jovian League on March 28 was devoted to accident preventive and the accomplishments of the Industrial Accident Commission of California. Nathan A. Bowers, Pacific Coast representative of the McGraw Publishing Company, as chairman of the day, introduced John R. Brownell, superintendent of the commission who ably presented the effective work of his organization.

The meeting for April 4 was a most enthusiastic one. Julean Arnold, American commercial attache at Peking, China, spoke on American commercial and engineering opportunities in the great Orient. Robert Sibley, editor Journal of Electricity, acted as chairman of the day.

R. M. Alvord, the newly-elected president of the League, outlined some very constructive policies for enlivening the attendance and effectiveness of the League activities for the coming six months. His committees are as follows:

Executive Committee—C. E. Wiggin, H. H. Hoxie, H. P. Pitts, E. E. Brown.
Finance Committee—C. E. Wiggin, L. A. Newbert, M. S. Orrick, Ed. Whaley, Garnett Young.
Entertainment Committee—H. P. Pitts, A. Fulton, R. G. Guyett, L. M. Hardie, W. J. Prendergast.
Publicity Committee—A. H. Halloran.
Local Newspaper Publicity—F. S. Myrtle.
Reception and Attendance—H. H. Hoxie, W. S. Coleman, C. F. Butte, E. M. Cutting, A. E. Drendell, D. E. Harris, J. T. Littlefield, T. W. Simpson, W. F. Neiman.
Public Affairs—H. C. Reid, A. H. Elliot, C. B. Kenny, P. J. Ost, F. C. Piatt.
Wiring Specifications—Chas. J. Wilson, J. M. Barry, E. E. Brown, L. M. Hardie, H. C. Reid.
Lecture Bureau—Miles Steel, F. E. Boyd, S. V. Walton.
Educational—E. E. Brown, N. A. Bowers, W. K. Brown, Geo. Curtiss, A. R. Thompson
Membership—W. F. Neelands, T. E. Collins, R. E. Fisher, J. C. Manchester, A. Meinema, N. R. Dunbar.

On Wednesday, April 12, Dr. Josiah Sibley, pastor of the well-known Calvary Presbyterian Church, addressed the League meeting on "Making Time." W. S. Coleman of the Pacific Gas & Electric Company acted as chairman of the day. The meeting was the largest attended for many weeks past and the outlook is most encouraging for future effective work of its members.

Sacramento Engineers' Club

In the rooms of the Board of State Reclamation, Major P. M. Norboe, assistant state engineer, called together an enthusiastic group of fifty engineers on the evening of April 3, 1917. The meeting was for the purpose of forming the Sacramento Engineers' Club which was successfully accomplished and the following were elected as officers: Major P. M. Norboe, president; G. R. Winslow, vice-president; Albert Givan, secretary; board of directors, Geo. S. Nickerson, W. D. Curtis, C. H. Wildman, E. M. Mackusick and Capt. J. A. Given.

The club plans to hold regular meetings the second Tuesday of each month.

Portland Sections of A. I. E. E. and N. E. L. A.

The joint meeting of the local sections of the A. I. E. E. and N. E. L. A. was held at the Hotel Multnomah on the evening of April 3. The speaker of the evening was R. W. Mastic and the subject was "A Field Investigation of Inductive Interference in Telephone Circuits Arising from Parallelism with a 55,000 Volt Power Circuit." L. T. Merwin was chairman of the meeting and an extended oral discussion was indulged in after the paper. Forty were present.

Oregon Society of Engineers

Oregon Society of Engineers held a meeting at the Central library Thursday evening, April 5. J. W. Swaren, hydro-electric engineer with the Pelton Water Wheel Company, San Francisco, gave an informal talk on "Some Interesting and Unique Bits of Engineering Construction," which have come to his notice in the course of his practice. The talk was illustrated by means of lantern slides. J. P. Newell, presided as chairman. An amendment to the constitution was prepared authorizing the formation of chapters of the Society outside of the city of Portland. Forty were present.

Convention Electrical Supply Jobbers' Association of the Pacific Coast, April 26-28, 1917

The convention of the Electrical Supply Jobbers' Association of the Pacific Coast will be held at Del Monte, California April 26-28, 1917.

There will be discussions, social events, golf tournaments, an open manufacturers' central station and jobbers' meeting, and the customary golf dinner. Owing to the large number of tourists at Del Monte there will not be so much room as usual, consequently the convention members must of necessity live a little closer. If you are coming send in your name at once to Albert H. Elliott so he can advise the hotel management and make the reservations. Pick out your room-mate if you can.

National Electrical Supply Jobbers' Association Convention

The ninth annual meeting of the Electrical Supply Jobbers' Association will be held at the Homestead Hotel, Hot Springs, Va., May 22-24, 1917.

BOOK REVIEW

Awakening of Business. By Edward N. Hurley. Size: 5½ by 8 in.; 240 pages. Published by Doubleday, Page & Co., of New York City, and for sale by the Technical Book Shop at San Francisco. Price $2.00.

As the author brings out in the introduction of this excellent book, we in America are in danger of forgetting that the suffering of the warring nations has rewards which in the long run may give them mastery over those nations which with self-complacency cling to ideas and methods of a passing age. America is now prosperous, but unless this period of prosperity is made a time for reorganizing the whole fabric of our business system, we shall suffer seriously in competition with European nations when they are again upon the normal business footing.

Interior Wiring. By Arthur L. Cook. Size: 4½ by 7½ in.; 416 pp.; replete with tables and illustrations; pliable binding. Published by John Wiley & Sons, Inc., of New York City and for sale at Technical Book Shop, San Francisco. Price $2.00.

This book is intended as a guide to modern practice in electric lighting and power applications, and in the design and installation of the wiring for such purposes.

There are many text-books which deal with the principles of operation of electrical apparatus and the methods of calculating electric circuits, but the usual electrical worker or the student does not possess a sufficient background of practical experience to enable him to use these principles to design a wiring installation. Here is a hand book of practical information that treats of these subjects on three main headings—electric lighting systems, electric power systems, interior wiring—and concludes with 48 tables of splendid condensed information in the appendix that are of great practical value. They are working tables that can be used to save long computations and to give definite information on the various problems involved in lighting and power applications.

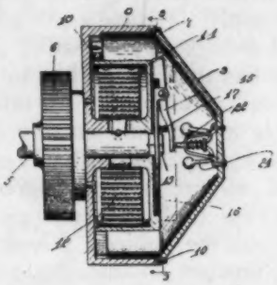
The author is head of the department of applied electricity at the Pratt Institute and was formerly electric power engineer for Westinghouse, Church, Kerr & Co. The book should receive immediate and hearty reception among the class of men for which it is designed.

WHAT WESTERN INVENTORS ARE DOING

(Deep-well pumping is proving a necessity in many arid districts of the West. Below is a brief description of an invention looking toward improvement of this nature. Other patents granted during the last two-week interval consist of a trolley-retriever, a thermometer for the cooling system of internal-combustion engines, a pressure-regulator and a plate-holder for X-ray exposures.—The Editor.)

1,219,713. **Trolley-Retriever.** Austin D. Eberly, Spokane, Wash.

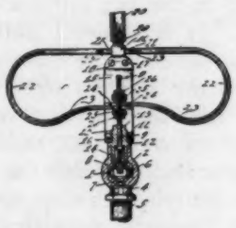
A trolley retriever, a shaft, a casing rotatably mounted thereon, an additional casing within the aforesaid casing also rotatably mounted on the shaft, a coil spring inclosed within the last mentioned casing and secured to the latter at its one end and secured to the shaft at its opposite end, spring



held means for normally holding the second mentioned casing under tension and against rotation, means for rotating the first mentioned casing at certain times, governor means operating therein for permitting the second mentioned casing to be rotated at certain times, and centrifugally operated means connecting the casings to rotate the same simultaneously upon the rotation of the second mentioned casing.

1,219,974. **Pressure-Regulator.** Charles R. McDonald, Long Beach. Cal.

A device of the character described, the combination of a pressure supply valve connected with the supply and service lines and having an extended valve stem, supporting means



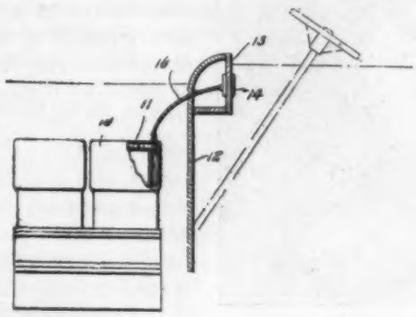
carried by the valve having an expansible and contractible pressure regulating tube held thereon, the tube being open and rigidly connected with the service line at one end, closed at the other end and adjustably and loosely connected with the valve stem, for permitting the movement of the tube relative to the valve stem when the tube is expanded and contracted.

1,219,965. **Plate-Holder for X-Ray Exposures.** Henry G. Leisenring, San Diego, Cal.

A device for taking X-ray photographs, comprising a metallic casing having a single open side, a covering of material, impervious to X-rays, upon the casing, the casing having registered openings in the opposite walls thereof, a plate of X-ray penetrable material placed over one of the wall openings, a plate holder adapted to retain a sensitized plate therein, a handle adapted to be placed around the plate holder and projecting from it, the plate holder being adapted to be moved laterally and longitudinally within the casing to bring a plate carried thereby between the openings.

1,220,150. **Thermometer for the Cooling Systems of Internal-Combustion Engines.** Oliver J. Williams, San Francisco,Cal. assignor to Philo M. Gelatt, La Crosse, Wis.

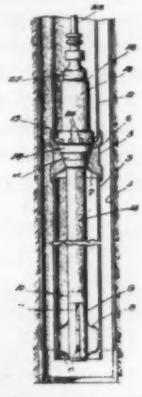
The combination with a motor vehicle and its internal combustion engine, the cylinder of which is provided with a jacket wall inclosing a chamber adapted to receive a cooling liquid, of a thermometer having its temperature re-



sponsive element secured in the jacket wall of the cylinder and projecting into the chamber where it is submerged in the cooling liquid therein, a temperature indicator located on the dash of the motor vehicle, and a flexible tube connecting the thermometer and the temperature indicating element, which tube is filled with a temperature responsive element.

1,219,799. **Deep-Well Pump.** Walter G. Black and August L. Segelhorst, Brea, Cal.

A deep-well pump, the combination with tubing, and a sleeve fitted in the tubing and having an internal conical bore forming a seat, of a pump barrel adapted to pass through the seat, a tapered anchor block secured on the pump barrel



and adapted to engage the seat, an anvil connected with and disposed above the anchor block, a plunger mounted within the pump barrel, a plunger rod secured to and rising from the plunger and passing through the anvil, means on the rod above the anvil to impinge upon the anvil and drive the anchor block to its seat, and means on the rod below the anvil to impinge upon the anvil and lift the anchor block from its seat.

LATEST IN EVERYTHING ELECTRICAL

(Engineers of the West approach the present international war crisis in America with unusual confidence in the value of service they feel they can render to the government at this solemn period of national life. Intense interest has been shown in the series of lectures that are being given in San Francisco looking toward military training for engineers. Here is a detailed account of the first three lectures of the series written by a captain of the corps of engineers and president of the examining board for the Engineer Officers' Reserve Corps.—The Editor.)

MILITARY TRAINING FOR ENGINEERS

BY R. PARK

A Mine Electrically Exploded

ON March 13th Major General J. Franklin Bell, commanding the Western Department, delivered the first of an extensive lecture course being given in San Francisco, Cal., prepared with the dual object of arousing interest in the Officers' Reserve Corps and Enlisted Reserve Corps, and also of rendering assistance to applicants in their preparation for the examination. The lecture course consists of 17 lectures, properly grouped so that every subject prescribed in W. D., G. O. 32, 1916, is covered. The course was arranged under the auspices of the military affairs committee of the San Francisco Section of the five national engineering societies working in close co-operation with the department engineer, Western department, and arranged primarily in the interests of the five technical arms of the service. General Bell issued Bulletin No. 8, Western department, 1917, setting forth the general character of the work of the corps of engineers, the quatermaster corps, the signal corps, the ordnance department and in February there were mailed from the Western department headquarters 3000 copies of this bulletin to engineers all over California together with a bulletin of the National societies showing the schedule of lectures. In response to these circulars, nearly 800 men of all professions attended General Bell's lecture, "The United States Army, its officers and enlisted reserve corps." The audience was most interested and during an hour and a half talk General Bell covered the general phrases of army life, and described the essential features of the Officers Reserve Corps and the Enlisted Reserve Corps, closing with a stirring appeal for all those in the audience to apply for some section of the Reserve Corps. General Bell is an interesting and convincing lecturer, and he has the rare ability to keep his audience absolutely in harmony with his talk, whatever be his subject. His lecture has already given the Reserve Corps a great impetus on the West coast.

The second lecture was delivered by Captain Richard Park, Corps of Engineers, to a crowded hall on March 20th, on the subject "General Duties of the Different Branches of the Service." After the close of an hour and a half lecture, the meeting was thrown open, and those in search of information had the opportunity to ask questions which were promptly answered by Captain Park, or by General Bell who intends to be present at each lecture of the series. After another hour, the meeting adjourned, the 500 odd men, mostly engineers, in the audience, having displayed an intense interest in all that was said. Many questions were asked about the Reserve Corps, and the enlisted Reserve Corps proposition was put squarely up to the engineers of San Francisco and the bay cities. There seems little doubt but that at least 3000 trained engineer workmen of the various classes could be recruited in the bay cities alone if they were properly reached. It is General Bell's plan to issue each lecture of the series in the form of a bulletin and to arrange with army officers or interested citizens in all the larger cities of the Western department, to have a similar lecture course for those interested, the San Francisco lectures to furnish the text. Since the course started on March 13th the number of applications received at Western department headquarters from the bay cities has more than doubled. It is esti-

Barbed Wire Entanglement—Electrically Charged

Destruction by Electrical Means of a Pontoon Bridge Crossing

mated that at the very least 200 applications in the Engineer Corps alone will directly result from the series. The San Francisco branches of the national societies are squarely behind the movement. Mr. J. D. Galloway, civil engineer, is the chairman of the military affairs committee with Allan D. Jones as secretary. Their committee hires a large lecture hall in Native Sons of the Golden West building, and for this and other necessary expenses levies an assessment on each man taking the lecture course, the sum of $1.50.

The third lecture in the lecture course for assisting civilians to prepare for examinations in the Officers' Reserve Corps, United States Army, now being held in San Francisco, Cal., under the direct supervision of Major General J. Franklin Bell, commanding general, Western department, was delivered on Tuesday, March 27th, by Captain George M. Marshall, aide to General Bell, on the subject of "Field Service Regulations"

Captain Marshall took up the various features of the Field Service Regulations and in a very interesting and instructive way presented the subject matter to the civilians to the number of over five hundred who crowded the lecture hall in the Native Sons of the Golden West building to overflowing.

The interest already aroused by this lecture course is resulting in a great increase in the number of applications received at these headquarters and forwarded to the various department chiefs in Washington. The Western department headquarters officers have their hands full in taking care of the thousands of applicants for information, not only in connection with the Officers' Reserve Corps, but in connection with the enlisted sections of that corps. Considerable progress has already been made in getting qualified civilians to enlist in the enlisted section of all branches, especially since the commissions have commenced to arrive for officers of the reserve corps who are enthusiastically working in the interest of their organization.

The fourth lecture of the series now being given in San Francisco to prepare civilians for commissions as officers of the Reserve Corps, U. S. Army, under supervision of Major General J. Franklin Bell, was delivered on Tuesday, April 3d, by Captain J. B. Murphy, A. D. C. to General Bell, on the subject, "Military Law."

About six hundred prospective candidates for the Reserve Corps in the various branches listened to the lecture, which was presented in a concise and instructive way. With a view of giving enough data so that the essential features covered in examinations would be made clear to all who heard the lecture, each of the lectures given in this course are to be issued in the form of Western Department Bulletins, but without any connection with the training of reserve officers, and copies will be gladly furnished by Western Department Headquarters on request for same.

The next lecture will be delivered by Capt. George M. Marshall, A. D. C. to General Bell, on the subject, "Infantry Drill Regulations of the United States Army."

WIRE YOUR HOME TIME CONTEST

Ever since the announcement regarding the "Wire Your Home Time" Prize Contest has been in the hands of the Central Station solicitors and the salesmen of the contractors the Society for Electrical Development has been rushed sending out contest blanks. The requests have come from the North, East, South and West in about equal numbers showing that the interest in this campaign is national.

The conditions of this contest are simple, permitting the salesmen of every member to try for a share of the $1250. The "Wire Your Home Time" committee has districted the country so that salesmen in the small cities have an equal chance with those in the metropolitan districts. There are five divisions with prizes of $250 for each division as follows:

Cities of less than 15,000 inhabitants.
Cities from 15,000 to 50,000.
Cities from 50,000 to 100,000.
Cities 100,000 to 500,000 and
Cities over 500,000.

The first prize in each division for the largest number of contracts will be $150; the prize for the second largest number of contracts will be $50 and the remaining five prizes for the next largest number of contracts will be $10 each.

Entries will be received at any time up to May 15, the closing date of the contest. Bulletins will be issued from time to time to show how the contest is coming on and what others are doing. Reports must be sent in on blanks furnished by the committee and postmarked not later than May 16.

Contestants are required to certify to the correctness of their reports by appearing before a notary and making affidavit to their number at the end of the campaign, or by certification by the local central station, general manager or new business manager.

The large number of contestants already entered insures a lively race, full of interest and one that will require staying power and "pep." Any contestant eligible should put in his application now.

ELECTRICITY FOR RURAL USE OBJECT OF CORRESPONDENCE COURSE

Electricity will soon be as universally used on the American farm as water or fire. To aid California farmers to live in the electrical age, the University of California Extension Division has announced a new correspondence course in "electricity for rural use."

NOTICE TO PUMP MANUFACTURERS, CONTRACTORS AND ELECTRIC MANUFACTURERS

A most important call for bids of pumping and electrical machinery by George Nelson, engineer for the Central Jacinto Irrigation Project, Willows, California, has arrived just as the forms for this issue are going to press. All interested must make sealed proposals by April 25, 1917, to the above engineer, from whom further information may be obtained, at the address given.

TRADE NOTE

The Catalog Numbering System of 338 Pine street, San Francisco, is the name of a new company just organized to perfect a universal filing system for catalogs. Peter Jurs in charge of catalog files at the Union Iron Works, is sponsor for the new development. The system is dependent upon a definite number being assigned to the manufacturer, which will bring about the filing of the catalogs according to size.

NEW BULLETIN

"Federal Load Building Service for Central Stations" is a question-and-answer pamphlet just issued by the Federal Sign System (Electric) that is proving to be a helpful and profitable aid for building up this form of central station load.

NEW ELECTRICAL DEVELOPMENTS

(The most striking new electrical development of the past two weeks interval is in the formation of many new highway lighting districts throughout various sections of the West. In California, where recent enabling enactments have been passed to assist unincorporated towns and villages to form highway lighting districts, this recent advance in improved highway illumination facilities is especially marked.—The Editor.)

FINANCIAL

BOISE, IDAHO.—A mortgage covering all power plants, substations, franchises and other properties has been filed for record by the Idaho Power Company, in 19 counties, in which it is operating in Idaho and Oregon. It is planned that $4,500,000 be issued on properties that were formerly subjected to nearly $19,000,000.

ILLUMINATION

FALLBROOK, CAL.—The board of supervisors are receiving bids for installing an electric lighting system and furnishing electric current for 8-250 c.p. series tungsten lights in the Fallbrook Public Highway Lighting District.

BENICIA, CAL.—Seventy-five thousand dollars will be spent by the Pacific Gas & Electric Company, installing a gas service in Benicia, if 400 signers can be secured. J. A. Royster is representing the company. A pipe line will be run from Vallejo.

RIVERSIDE, CAL.—The common council has passed an order for the improvement of Main street between Tenth and Fourteenth streets by the installation on each side of the street of electric poles, conduits and lamps for purposes of lighting.

MONTEBELLO, CAL.—An application has been made to the board of trustees of Monterey Park for the sale to the highest bidder of a franchise to construct and maintain for a period of 40 years a system of gas pipes and pipe lines for the city of Monterey Park.

MESA, ARIZ.—The council has come to an agreement with Manager Chandler of the South Side Gas & Electric Company for the purchase of the company's plant on a basis of $113,000. As soon as the proper steps can be taken the proposition will be put up to the voters of the town.

NEW VERMONT SQUARE, CAL.—A large percentage of the residents in New Vermont Square district are signed up for the lighting of their homes. The city is installing a municipal street lighting system through the square, which when completed will have an arc light at every street intersection.

TEKOA, WASH.—The city council will begin the investigation of the feasibility of a municipal electric lighting plant as the result of a petition presented by a large body of citizens. A committee consisting of Councilmen K. W. Tyler, E. R. Jones and M. Bartholomew was appointed to have charge of the investigation.

HOQUIAM, WASH.—A second special election on the proposal to bond the city for funds to condemn the electric light and power distributing plant of Hoquiam or to construct a new plant, may be called at the same time as the proposed special election to bond the city for $170,000 to take up all outstanding current expense warrants.

NOGALES, ARIZ.—This city will install 100 cluster lamps on Frank avenue and Morley avenue, Arroyo boulevard and Park and Court streets, and 150 bracket lamps on other streets, all 200 ft. apart. The lamps in the clusters are to be 100 watt incandescent burners and four 60 watt burners of the same kind. Bracket lamps are to carry one lamp each of 100 watts. The posts are to be of ornamental iron.

TRANSMISSION

YUMA, ARIZ.—The board of supervisors has granted an electric power and light franchise to the Yuma Light, Gas & Power Company, which enables it to extend its lines over the county outside of Yuma.

SEATTLE, WASH.—Bids are being received by the board of public works for furnishing all labor and material involved in the construction and installation of an additional unit to the city's steam electric plant.

SAN BERNARDINO, CAL.—Damon Cooley of this city and V. K. McMains of Los Angeles have filed application asking authority to build a power plant and system in the Big Bear Valley to furnish electricity to hotels at Pine Knot and Knight's Camp.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company has taken over the Escondido Utilities Company holdings and has placed Lester A. Wright in charge at Escondido as manager. An extension of the power line from Oceanside will be made to carry current to Escondido.

TELEPHONE AND TELEGRAPH

BISHOP, CAL.—A petition of Frank Pellissier and R. S. Moore for a franchise for a telephone and telegraph line from Bishop north was rejected by the board of supervisors.

TUCSON, ARIZ.—The usual spring repairing of telephone lines from Tucson to forest stations in Rincon and Santa Catalina mountains has been ordered by Superintendent Johnson of Coroncado-Chiricahua forest headquarters here.

GARDNERVILLE, NEV.—The Bell Telephone Company has applied to the Churchill County Commissioners for the privilege to extend their toll line from Wadsworth to Fallon. They offer to rebuild the present line. It will probably cost $10,000 to rebuild the line.

TRANSPORTATION

SAN FRANCISCO, CAL.—Bids are being received by the board of public works for furnishing and delivering underground material on contract No. 83, Municipal Railway System.

LOS ANGELES, CAL.—The board of supervisors has granted the Pacific Electric Railway Company a franchise to construct and maintain an electric railroad along certain public roads and highways in Los Angeles County.

IRRIGATION

EL CENTRO, CAL.—A plan involving the expenditure of $10,000,000 and the construction of an aqueduct ten miles long, reaching from the heart of the San Bernardino Mountains to the Mexican boundary line in Imperial Valley for the purpose of delivering domestic water sufficient for 100,000 people; to irrigate 60,000 acres of land and provide 78,000 hydroelectric horsepower was announced by Colonel W. H. Holabird.

SAN FRANCISCO, CAL.—Edward N. Pearson Jr., has issued a special communication concerning $150,000 Anderson-Cottonwood Irrigation District, first issue, 6 per cent serial gold bonds. The Anderson-Cottonwood Irrigation District has a population of about 3000. It is comprised of 31,840 acres lying between Redding and Cottonwood. The estimated present market value of the land alone, excluding all improvements, is $2,650,000.